Unified Green

Concept Design for Green Stormwater Infrastructure at Big Eleven Lake & Waterway Park

Unified Government of Wyandotte County and Kansas City, Kansas

Integrated Overflow Control Plan
Project No. 98069
4/30/2018

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prepared for

Unified Government of Wyandotte County and Kansas City, Kansas

Integrated Overflow Control Plan
Kansas City, KS

Project No. 98069

4/30/2018

prepared by

Burns & McDonnell Engineering Company, Inc.

Kansas City, Missouri

INDEX AND CERTIFICATION

Unified Government of Wyandotte County and Kansas City, Kansas
Unified Green
Project No. 98069

Report Index

Certification

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Brenda R. Macke, P.E.
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TABLE OF CONTENTS

Page No.

LIST OF TABLES

Page No.

LIST OF FIGURES

Page No.

LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
BPU	Board of Public Utilities
CSO	combined sewer overflow
CSS	combined sewer system
E	East
EPA	Environmental Protection Agency
E&S	erosion and sediment
GSI	green stormwater infrastructure
HCW	Healthy Communities Wyandotte
IOCP	Integrated Overflow Control Plan
LIDAR	Light Detection and Ranging
N	North
NGICP	National Green Infrastructure Certification Program
NOAA	National Oceanic and Atmospheric Administration
RTC	Real Time Controls
UG	Unified Government of Wyandotte County and Kansas City, Kansas
WEF	Water Environment Federation
WQv	water quality volume

REFERENCES

Burns & McDonnell, Inc., September 2016, Draft Integrated Overflow Control Plan

Burns & McDonnell, Inc., March 2013, Sewer System Evaluation Work Plan

Mid-America Regional Council & American Public Works Association Kansas City Metro Chapter, October 2012, Manual of Best Management Practices for Stormwater Quality

Unified Government of Wyandotte County and Kansas City, Kansas Parks & Recreation Department, 2017, Parks Masterplan

Unified Government of Wyandotte County and Kansas City, Kansas Urban Planning & Land Use, 2014, Downtown Parkway District: The Healthy Community Vision for Downtown Kansas City, Kansas

Unified Government of Wyandotte County and Kansas City, Kansas Urban Planning & Land Use, April 2007, Draft Downtown Master Plan

Young & McEnroe, June 2002, Precipitation Frequency Estimates for the Kansas City Metropolitan Area

1.0 INTRODUCTION

The proposed Big Eleven Lake/Waterway Park Green Stormwater Infrastructure (GSI) concept is located in Kansas City, Kansas and is referred to herein as the Unified Green project. The project is within a combined sewer basin tributary to a combined sewer overflow (CSO) outfall that is prioritized for overflow reduction, CSO 19. The system is characterized by segments of separate storm sewer that ultimately merge into a single combined sewer pipe, making the system as a whole combined. The concept is primarily a CSO reduction project that proposes to expand on and improve connection of the current separate sewer portions of the system, construct new distributed and centralized GSI, retrofit existing GSI, and retrofit Big Eleven Lake to maximize its function and benefit. The concept features a reconnection of two existing parks by creating a pedestrian-friendly greened corridor that demonstrates a variety of GSI technologies. The project has potential to integrate with and complement planned major development initiatives in the area by creating a “Unified Green” Pilot Demonstration as part of Partial Consent Decree obligations agreed to between the Unified Government of Wyandotte County and Kansas City, KS (UG) and the Environmental Protection Agency (EPA).

Figure 1-1 displays the Unified Green project site. The site is situated along the natural drainage path of the watershed tributary to CSO 19 at Jersey Creek, making it an ideal location for centralized GSI. The strategic sewer separation and GSI solutions have the potential to capture and treat the water quality volume (WQv) for approximately 114 acres of drainage area. The WQv is defined as the 1.37-inch rainfall event in the Mid-America

Figure 1-1: Project Location

Regional Council Manual of Best Management Practices for Stormwater Quality (MARC BMP Manual), which represents the storage needed to capture and treat 90 percent of the average annual stormwater runoff volume. Sewer separation is separating the combined, single pipe system currently used for both sanitary and stormwater flows into two separate sewer systems. Strategic sewer separation implements an approach that maximizes the stormwater benefit while minimizing the cost by separating targeted areas only and utilizing the existing system and infrastructure where possible. Big Eleven Lake also provides an opportunity to temporarily detain larger storm events and to provide a flood reduction benefit downtown.

The proposed concept consists of four phases of design and construction, as shown on .

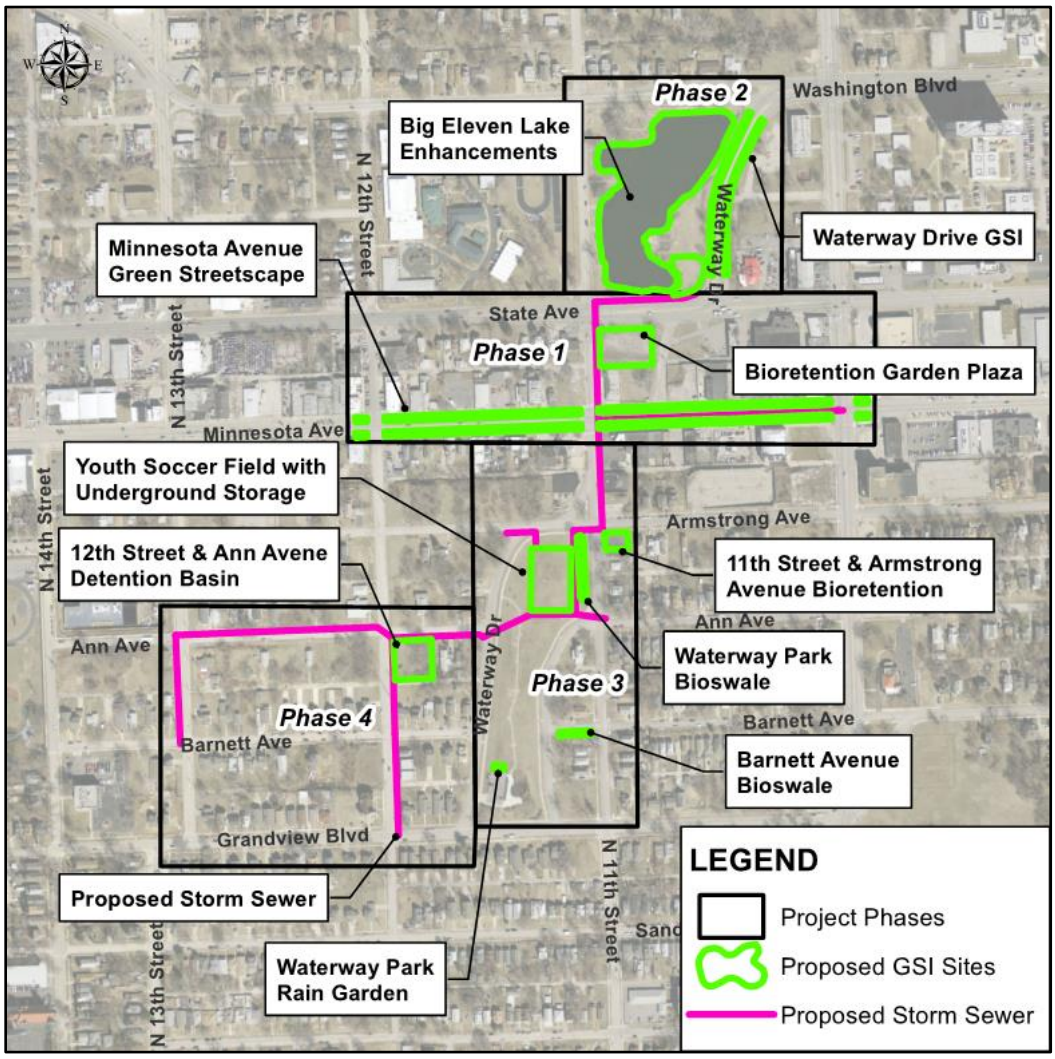

Figure 1-2: Project Phases

Phases include the following:

- Phase 1: Green streetscape corridor along Minnesota Avenue integrated into the Downtown Parkway District: The Healthy Community Vision for Downtown Kansas City, Kansas (UG Urban Planning & Land Use, 2014) (Healthy Campus Plan) development.
- Phase 2: Enhancements to Big Eleven Lake and surrounding area with and modifications to the lake outlet control structure to control outflow and provide temporary stormwater storage.
- Phase 3: Youth soccer field with underground stormwater storage and variety of distributed GSI in Waterway Park.
- Phase 4: Strategic storm sewer separation between N 13th Street and N 10th Street, from Grandview Boulevard to State Avenue at Big Eleven Lake.

The following sections provide details and considerations for the conceptual design of the project**.** An overview of the conceptual design features for the Unified Green project is shown in Appendix A. This report includes the following sections summarizing the Unified Green conceptual design project.

2.0 Hydrologic Screening
3.0 Land Use and Property Acquisition Screening
4.0 Project Phasing
5.0 Existing Resources Screening
6.0 Project Conceptual Design Parameters
7.0 Project Benefits
8.0 Opinion of Probable Cost
9.0 Recommended Next Steps

2.0 HYDROLOGIC SCREENING

The total area to be controlled by the proposed improvements is approximately 114 acres with an estimated 51-percent of this area impervious. A majority of the area generally drains towards Big Eleven Lake at N 11th Street and State Avenue, but no stormwater inlets, pipes or culverts drain directly to Big Eleven Lake. The streets and adjacent area surrounding the park drain to stormwater inlets that are connected to the combined sewer system (CSS), and therefore Big Eleven Lake currently only receives direct stormwater runoff from the immediate park area during a majority of rainfall events. The proposed green improvements will convey stormwater to Big Eleven Lake using a combination of streetscape GSI, centralized GSI, and strategic sewer separation upstream of Big Eleven Lake Park. Being situated in the natural drainage path of the basin provides an opportunity to collect stormwater from surrounding areas. Incorporating GSI upstream of the lake offers an opportunity to promote stormwater infiltration and improve water quality for the more frequent storms, while utilizing new separate storm sewer to convey the less frequent rainfall to Big Eleven Lake for detention. **Figure 2-1** displays the total drainage area for the Unified Green project.

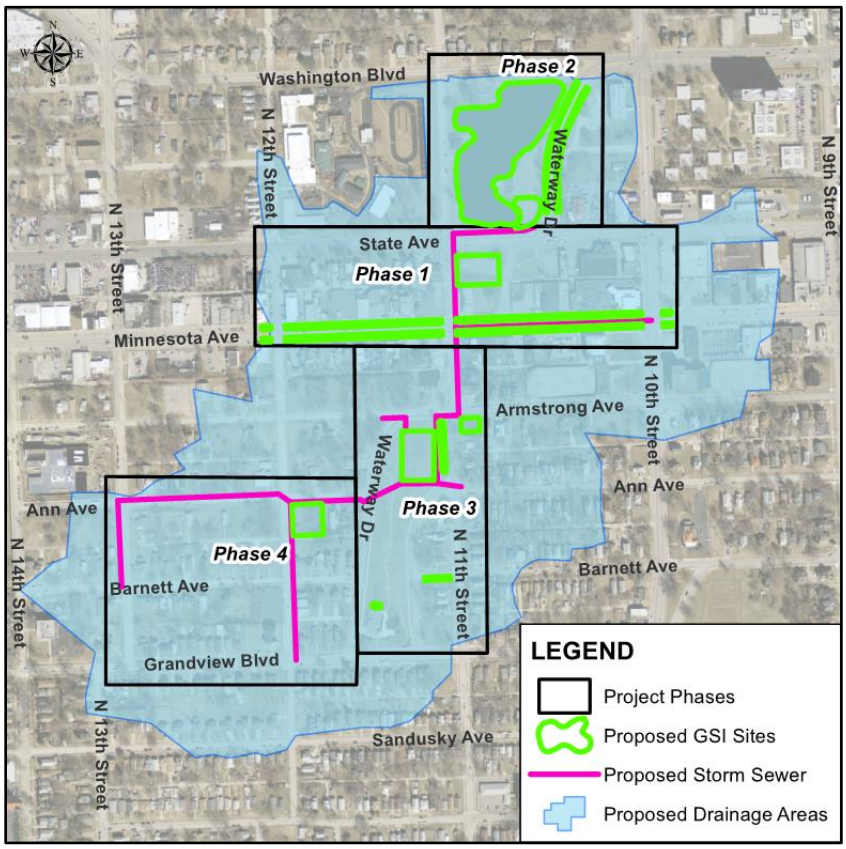

Figure 2-1: Project Drainage Area

3.0 LAND USE AND PROPERTY ACQUISITION SCREENING

A majority of the drainage area is zoned as single family/apartment with more commercial/central business type land uses along Minnesota Avenue and State Avenue. The proposed GSI sites are primarily situated on public parks, Land Bank parcels, vacant parcels, or in the public right of way. The abundance of available open land gives UG the opportunity to pilot a variety of green technologies. shows the impacted park, Land Bank and vacant parcels in the proposed project area.

GSI was sited on the large collection of Land Bank, vacant and park parcels in the project drainage area and along Minnesota Avenue to provide multi-benefit opportunities for neighborhood revitalization and economic development integration. By installing GSI facilities along the N 11th Street corridor, the UG has an opportunity to reconnect and enhance existing parks through a corridor defined by stormwater features. This green corridor will improve stormwater collection and conveyance, utilize green stormwater bump-outs to create designated parking and promote pedestrian safety, and promote redevelopment through the area.

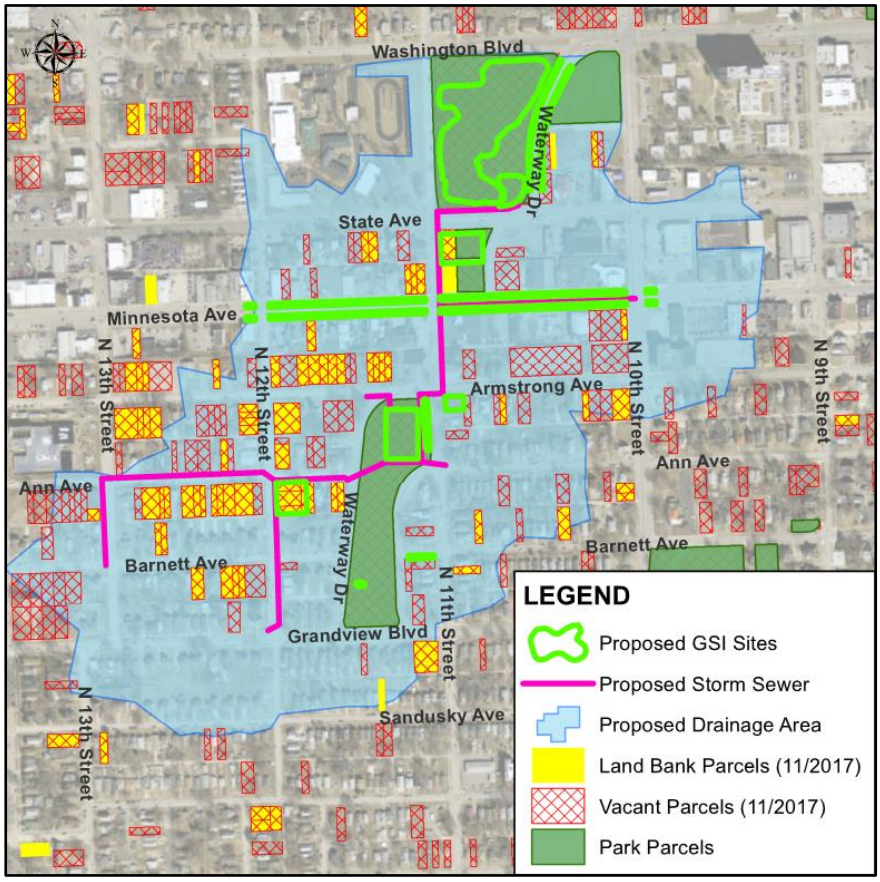

Figure 3-1: Land Bank Parcels, Vacant Parcels, and Park Parcels with Project Drainage Area

4.0 PROJECT PHASING

The concept design is separated into four phases of design and construction to provide the UG with flexibility related to timing and funding of the proposed improvements. The four project phases are identified on . Phase 1 and 2 can be substituted for one another or built concurrently, depending on development associated with the Healthy Campus Plan identified parcels between N 10th Street and N 11th Street, immediately north of Minnesota Avenue. Phases 3 and 4 cannot proceed until Phase 2 is complete, and a stormwater connection is constructed to Big Eleven Lake.

4.1 Phase 1

Phase 1 includes the following major stormwater infrastructure improvements, as shown on **Figure 4-1** and detailed in the following subsections:

1. Strategic sewer separation on N 11th Street and State Avenue
2. Bioretention garden plaza on the Healthy Campus Plan site
3. Green streetscape improvements on Minnesota Avenue including permeable pavers with underground storage
4. Stormwater pretreatment device

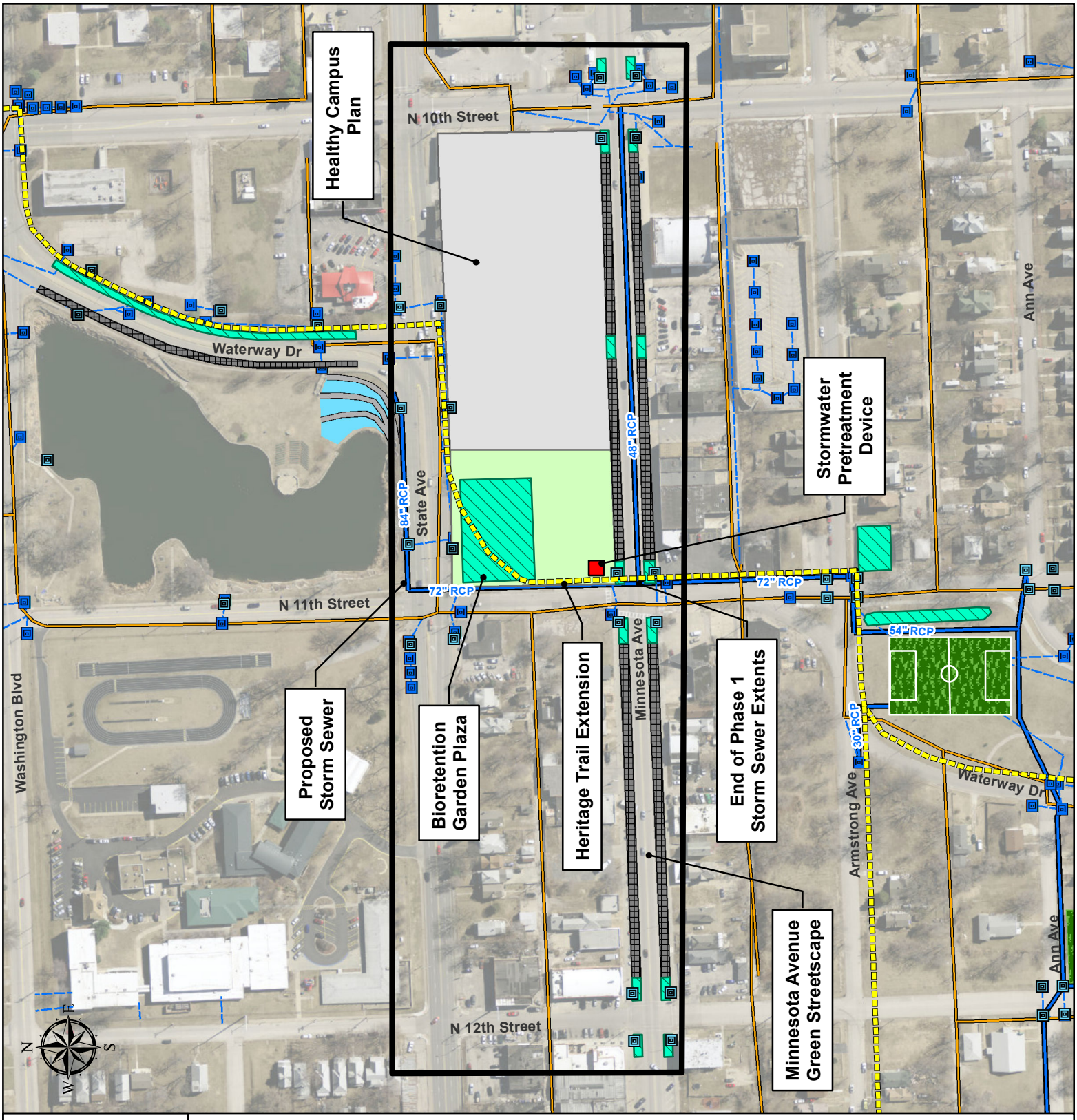

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Figure 4-1
Phase 1 Conceptual GSI Improvements

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LEGEND

- Healthy Campus Footprint
- Healthy Campus Open Space
- Heritage Trail Extension
- Stormwater Pretreatment Device
- New Storm Inlet
- Proposed Storm Sewer
- Pretreatment Forebay
- Bioretention
- Permeable Pavers
- Existing Storm Inlet
- Existing Storm Sewer
- Existing Combined Sewer

0 120 240 360 480 Feet

4.1.1 Strategic Sewer Separation

A primary stormwater interceptor will be constructed within the N 11th Street corridor to ultimately convey separate stormwater flows to Big Eleven Lake. The conveyance pipe associated with this separation will be sized to match design criteria for the desired stormwater level of service for the project. As part of Phase 1, the stormwater interceptor will be constructed from the Minnesota Avenue intersection to the southeast corner of Big Eleven Lake. An existing separate storm line made of vitrified clay pipe on Minnesota Avenue which is likely close to its end-of-material life will also be replaced to provide conveyance along the Minnesota Avenue corridor. The separation will include new inlets strategically placed for collection of stormwater at the intersections of N 10th Street and Minnesota Avenue, N 11th Street and Minnesota Avenue, and N 11th Street and State Avenue. The GSI facilities along Minnesota Avenue will dewater to this new separate storm system.

Phase 1 is currently assumed to be implemented first, concurrent with the proposed development of the Healthy Campus Plan. Because Phase 1 is constructed prior to the Phase 2 modifications at Big Eleven Lake Park, Phase 1 must include the construction of a temporary combined sewer connection from the separate storm sewer installed near N 11th Street and State Avenue to the existing 51-inch combined sewer. Once Phase 2 is complete, the temporary combined sewer connection will be removed, and the storm sewer will convey flow from the Phase 1 drainage area to the pretreatment forebay and Big Eleven Lake, discussed in Section 4.2.2. In the event that Phase 2 proceeds Phase 1, this temporary connection to the combined sewer is not necessary, and the separate storm sewer can be directly connected to Big Eleven Lake.

4.1.2 Bioretention Garden Plaza

This bioretention garden plaza is located on the southeast corner of N 11th Street and State Avenue and is intended to provide storage and infiltration for the water quality volume from the tributary area. Low flows will be diverted from the new stormwater interceptor into this facility, while larger flow rates will remain in the interceptor so that the bioretention facility can remain offline. The bioretention plaza design and construction should integrate with proposed features for development of the adjoining Healthy Campus Plan site, and can include a pedestrian link between the northeast corner of N 11th Street and Minnesota Avenue to a mid-block crossing of State Avenue to Big Eleven Lake. **Figure 4-2** provides an example of how the bioretention garden plaza could look.

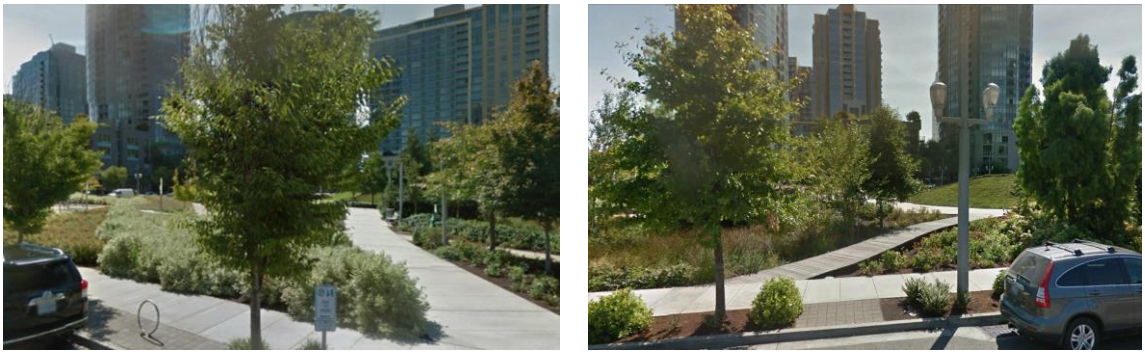

Figure 4-2: Bioretention Garden Plaza Example
(Elizabeth Caruthers Park, Portland OR, © 2017 Google)

4.1.3 Minnesota Avenue Green Streetscape

Minnesota Avenue currently has angled parking on the north and south sides of the street, from N 12th Street east to N 10th Street, creating a wide pavement section with very little definition for traffic, parking, and pedestrian areas. A green streetscape along this corridor would define these existing parking areas through corner and mid-block bioretention bump-out features and the use of permeable pavers in the angled parking area. The bump-out features also create a defined pedestrian crossing zone with shorter crossing distances, providing a safer and more pedestrian-friendly intersection. The bump-out features at N 11th Street and Minnesota Avenue could also integrate a level platform feature for boarding buses at this existing bus stop locations. In addition to providing a stormwater benefit, these green features help define both transportation and pedestrian uses within the corridor. **Figure 4-3** provides an example of a bump-out feature and a permeable pavement parking area.

Figure 4-3: Bump-out and Permeable Pavement Parking Examples
(Pilot Project, Kansas City, MO; E 81st Street & Troost Avenue, Kansas City, MO)

4.1.4 Stormwater Pretreatment Device

The intent of a stormwater pretreatment device is to remove trash and sediment upstream of the bioretention garden plaza and Big Eleven Lake. An example of this type of system is a Suntree manufactured device. The key components of this system for the purposes of this project is to remove trash and floatables along with sediment settling chambers. **Figure 4-4** shows an example of a stormwater pretreatment device. For this project it is proposed that the device be installed near the intersection of N 11th Street and Minnesota Avenue.

Figure 4-4: Stormwater Pretreatment Device Example
(E 81st Street & Troost Avenue, Kansas City, MO)

4.2 Phase 2

Phase 2 includes the following major green stormwater infrastructure improvements, as shown on **Figure 4-5** and detailed in the following subsections:

1. Retrofit of the outlet structure in Big Eleven Lake and Opti Real Time Controls technology
2. Pretreatment forebay for a new stormwater pipe discharge point to Big Eleven Lake
3. GSI along Waterway Drive between State Avenue and Washington Boulevard

Phase 2 facilitates construction of the remaining project phases, as it provides the connection of the stormwater interceptor to the available storage at Big Eleven Lake. Phase 2 must be constructed prior to allowing stormwater from the new separate storm interceptor to discharge at Big Eleven Lake. Phase 2 also removes the temporary combined sewer connection from the separate storm sewer installed near N 11th Street and State Avenue as part of Phase 1. Once all project phases are complete, this storm sewer will serve as the primary stormwater interceptor that will ultimately direct drainage from the entire project area to the pretreatment forebay and Big Eleven Lake.

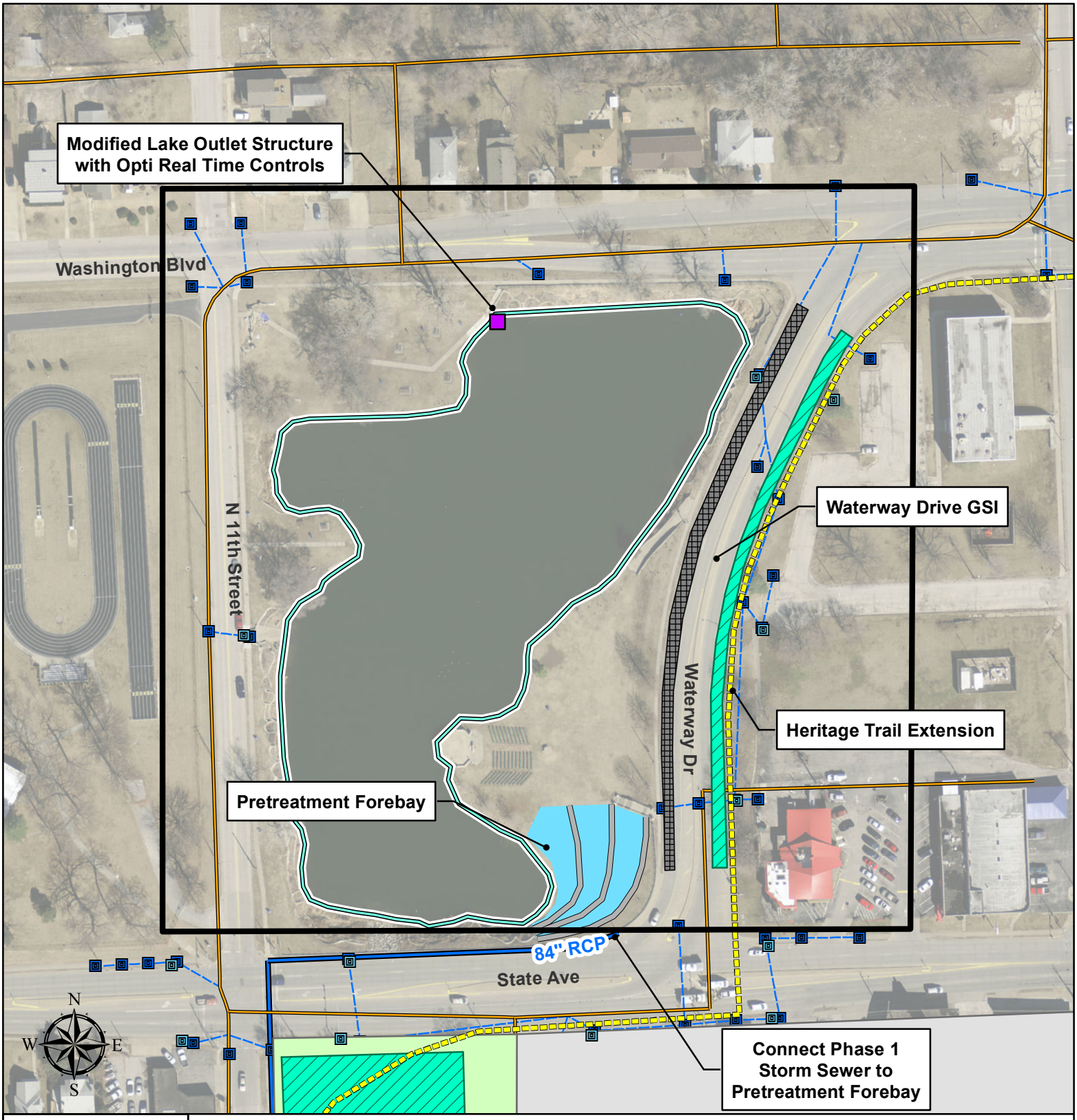

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Figure 4-5
Phase 2 Conceptual GSI Improvements

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LEGEND

- Healthy Campus Footprint
- Healthy Campus Open Space
- Heritage Trail Extension
- New Storm Inlet
- Proposed Storm Sewer
- Modified Lake Outlet Structure
- Modular Wall
- Pretreatment Forebay
- 6" Concrete Cap
- Bioretention
- Permeable Pavers
- Existing Storm Inlet
- Existing Storm Sewer
- Existing Combined Sewer

0 70 140 210 280 Feet

4.2.1 Big Eleven Lake Outlet Structure Retrofit and Opti Real Time Controls

The Big Eleven Lake outlet structure will be modified to provide controlled release of stormwater back to the combined sewer for the desired project area level of service. The existing outlet structure is an area inlet open on all sides that allows a constant baseflow out of the lake and into the CSS. The outlet structure will be designed to allow for temporary storage of both small and large storm events within Big Eleven Lake Park to provide both combined sewer overflow reduction and flood control benefits. The outlet structure can be designed to dewater the site back to normal permanent pool water levels within 24 to 48 hours, to minimize impact to the current park usage.

The outlet structure will also include a retrofit for Opti Real Time Controls (RTC), as shown on **Figure 4-6**. Opti RTC is a cloud-based platform that communicates with the installed hardware at the site via telemetry. The Opti RTC technology allows for remote monitoring and active control of stormwater management facilities, utilizing site-specific sensor information and National Oceanic and Atmospheric Administration (NOAA) forecasting for automated dewatering. Opti RTC is recommended at the outlet structure for Big Eleven Lake to optimize storage by adjusting water levels based on forecasted rain events to provide additional stormwater storage capacity in the lake. This technology provides a cost-effective solution for overflow control by storing stormwater in Big Eleven Lake and slowly releasing it back into the combined sewer system after the peak flow from the rain event has passed.

Figure 4-6: Opti Real Time Control Technology
(Gardner Avenue Detention Basin, Kansas City, MO)

4.2.2 Pretreatment Forebay

A forebay will provide pretreatment for stormwater routed to Big Eleven Lake from the upstream sewer separation. The proposed design includes serpentine flow path pretreatment, where stormwater is routed through a three-tiered forebay prior to discharging to the southeast corner of Big Eleven Lake. The tiers can be constructed using a stone style that mimics the existing historic stone walls found throughout Downtown Kansas City, Kansas and around Big Eleven Lake. This southeast corner of the lake can also be modified to include more wetland type plantings to provide additional pretreatment and water quality improvement for stormwater introduced to the lake. An example of how the existing wall could be extended was included in the Healthy Campus Plan and is shown in **Figure 4-7**.

Figure 4-7: Pretreatment Forebay Wall Example
(UG Urban Planning & Land Use, 2014, p. 41; State Avenue & Waterway Drive, Kansas City, KS)

4.2.3 Waterway Drive GSI

Vacating all or a portion of Waterway Drive east of Big Eleven Lake and repurposing the right of way will provide parking for park users and a connection to the Beatrice L. Lee Community Center. The current proposed layout included in this concept shows closing the outer two lanes on Waterway Drive for bioretention and permeable paver parking areas to provide treatment and storage for stormwater runoff primarily from the Community Center and commercial properties to the east. A variety of configurations are possible for the Waterway Drive GSI, pending traffic pattern criteria, including full closure of the right of way or closure of one half of the existing 4-lane road. The GSI would dewater to a separate storm sewer, which would direct larger storm flows to the pretreatment forebay for Big Eleven Lake.

4.3 Phase 3

Phase 3 includes the following major green stormwater infrastructure improvements, as shown on **Figure 4-10** and detailed in the following subsections:

1. Strategic storm sewer separation
2. Bioretention on the southeast corner at the intersection of N 11th Street and Armstrong Avenue adjacent to Waterway Park
3. Bioswale along Barnett Avenue from N 11th Street to Waterway Drive on the east side of Waterway Park
4. Youth soccer field with underground storage in Waterway Park
5. Retrofitting an existing rain garden and an existing bioswale in Waterway Park

Phase 3 can be constructed once the strategic separation is completed from Phase 1, and the Big Eleven Lake improvements are completed from Phase 2. Phase 3 sewer separation connects the proposed storm sewer in Phase 3 to the primary storm sewer alignment in Phase 1 at N 11th Street and Minnesota Avenue. Once Phase 3 is complete, the storm sewer will convey flow from the Phase 3 drainage area to the pretreatment forebay and Big Eleven Lake.

4.3.1 Strategic Sewer Separation

The proposed sewer separation will connect to the storm sewer at Minnesota Avenue and N 11th Street, constructed as part of Phase 1, and extend south towards and through Waterway Park to the intersection of Waterway Drive and Ann Avenue. The separation will include new inlets strategically placed for collection of stormwater at the intersections of N 11th Street and Armstrong Avenue, N 11th Street and Ann Avenue, and N 11th Street and Barnett Avenue. The proposed alignment will integrate and utilize the existing separate storm sewer through the park, and route stormwater flows to the underground storage at the youth field. The proposed storm sewer alignment allows for the disconnection of the existing separate storm sewer from the combined sewer and reroutes additional drainage area to Big Eleven Lake.

4.3.2 11th & Armstrong Bioretention

This bioretention is located at the southeast corner of N 11th Street and Armstrong Avenue and is intended to provide storage to treat the water quality volume from the drainage area for Armstrong Avenue east of N 11th Street. The bioretention can replace a dilapidated structure adjacent to the entrance of Waterway Park and promote connectivity between the parks and the new pedestrian corridor along N 11th Street. **Figure 4-8** shows the existing structure at the proposed bioretention site and an example photo of a bioretention garden in a similar setting.

Figure 4-8: Bioretention Example
(N 11th Street & Armstrong Avenue, Kansas City, KS; E 81st Street & Lydia Avenue, Kansas City, MO)

4.3.3 Youth Soccer Field with Underground Storage

Re-grading of the north lawn of Waterway Park for a youth soccer field with underground storage is proposed to create a more usable space for the community, while providing storage and treatment for the water quality volume of the surrounding neighborhood. The existing park space is currently being used as a soccer practice field, but is characterized by an uneven, poorly vegetated ground surface with a large grate inlet in the middle of the play area. The underground storage utilizes the existing and new separate storm system through the park to convey water to a series of plastic storage chambers with aggregate bedding and filter layers, under a well-draining soil and grass layer. The soccer field is currently sized for United States Youth Soccer 12U age group with the ability to be sub-divided into four 8U/6U fields. **Figure 4-9** shows an example application of underground storage (left) as well as a newly constructed field with drainage system (right) that was implemented as part of a larger GSI wetland/detention project. The underground storage would be designed to dewater to the new separate storm sewer and ultimately to Big Eleven Lake for secondary treatment and storage.

Figure 4-9: Underground Storage Example
(adswater.com.au; E 81st Street & Troost Avenue Wetland Detention Facility, Kansas City, MO)

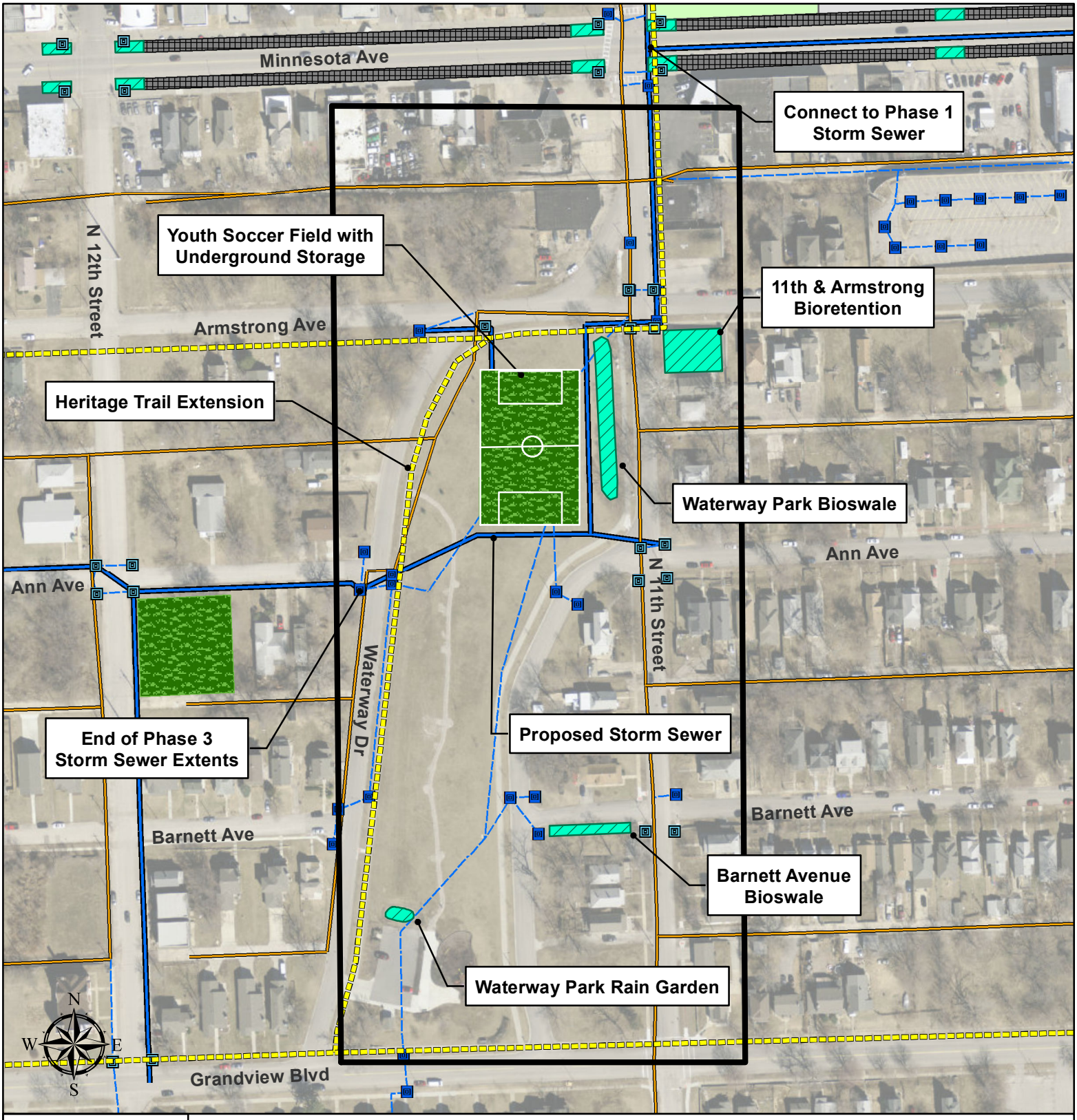

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Figure 4-10
Phase 3 Conceptual GSI Improvements

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LEGEND

- Healthy Campus Footprint
- Healthy Campus Open Space
- Heritage Trail Extension
- New Storm Inlet
- Proposed Storm Sewer
- Bioretention
- Detention
- Permeable Pavers
- Existing Storm Inlet
- Existing Storm Sewer
- Existing Combined Sewer

Feet
0 90 180 270 360

4.3.4 Barnett Avenue Bioswale

The bioswale along Barnett Avenue will extend between N 11th Street and Waterway Drive and function primarily as a conveyance and pretreatment mechanism. The bioswale will convey flows from the drainage area east of Waterway Park, collected by new inlets at the intersection of N 11th Street and Barnett Avenue, to the existing storm sewer in Waterway Park. The existing storm sewer will be routed to the proposed underground storage in Waterway Park.

4.3.5 Waterway Park GSI Retrofits

Enhancements to the existing rain garden adjacent to the parking lot and improvements to the existing bioswale adjacent to N 11th Street are proposed to improve the current function of the GSI and maximize the investment the UG has made into this infrastructure, as shown on **Figure 4-11** and **Figure 4-12**. Stormwater currently entering the grate inlet in the Waterway Park parking lot will be directed to the existing rain garden north of the parking lot. Additional flow and soil amendments in the rain garden would allow for heartier vegetation to be planted and thrive. The existing bioswale on the northeast end of Waterway Park is currently characterized by scarce vegetation and erosion due to short-circuiting of the facility due to the existing outlet structure configuration. Re-grading the area for a youth soccer field, discussed in Section 4.3.3, will create positive drainage toward the existing Waterway Park bioswale. Establishing more flow to the existing bioswale, adding amended soils, and raising the invert elevation of the outlet structure from the bioswale would encourage healthier vegetation and increase aesthetic appeal along the Waterway Park walking trail. The outlet structure would be connected to the new separate storm sewer and these flows would ultimately be directed to Big Eleven Lake for secondary treatment and storage.

Figure 4-11: Waterway Park Rain Garden
(Waterway Park, Kansas City, KS)

Figure 4-12: Waterway Park Bioswale
(Waterway Park, Kansas City, KS)

4.4 Phase 4

Phase 4 extends the strategic sewer separation from Phase 3 west of Waterway Park and a detention basin at N 12th Street and Ann Avenue. Phase 4 sewer separation connects the proposed storm sewer in Phase 4 to the storm sewer in Phase 3 at Ann Avenue and Waterway Drive. Once Phase 4 is complete, the storm sewer will convey flow from the Phase 4 drainage area to the pretreatment forebay and Big Eleven Lake. Phase 4 improvements are shown on **Figure 4-14** and detailed in the following subsections:

1. Strategic storm sewer separation
2. Detention on the southeast corner at the intersection of N 12th Street and Ann Avenue

4.4.1 Strategic Sewer Separation

Strategic sewer separation from Phase 3 extends west of Waterway Park on Ann Avenue to N 13th Street, south on N 13th Street to Barnett Avenue, and on N 12th Street from Grandview Boulevard to Ann Avenue. The separation will include new inlets strategically placed for collection of stormwater at the intersections of N 12th Street and Grandview Boulevard, N 12th Street and Ann Avenue, N 13th Street and Ann Avenue, and N 13th Street and Barnett Avenue. Once Phase 4 sewer separation is complete, the entire 114-acre drainage area upstream of Big Eleven Lake will be separated and ultimately routed to the lake for treatment and temporary storage.

4.4.2 12th & Ann Detention Basin

The separate storm sewer on N 12th Street from Grandview Boulevard to Ann Avenue will convey the low flows to a detention basin on the southeast corner of the N 12th Street and Ann Avenue intersection, allowing larger flows to remain in the storm sewer and ultimately be routed to Big Eleven Lake. The detention basin would temporarily store the water quality volume for the drainage area to the south and dewater to the new separate storm sewer on Ann Avenue. **Figure 4-13** shows the existing site conditions as well as an example detention basin application.

Figure 4-13: Detention Basin Example
(N 12th Street and Ann Avenue, Kansas City, KS; Lydia Avenue and E 83rd Terrace, Kansas City, MO)

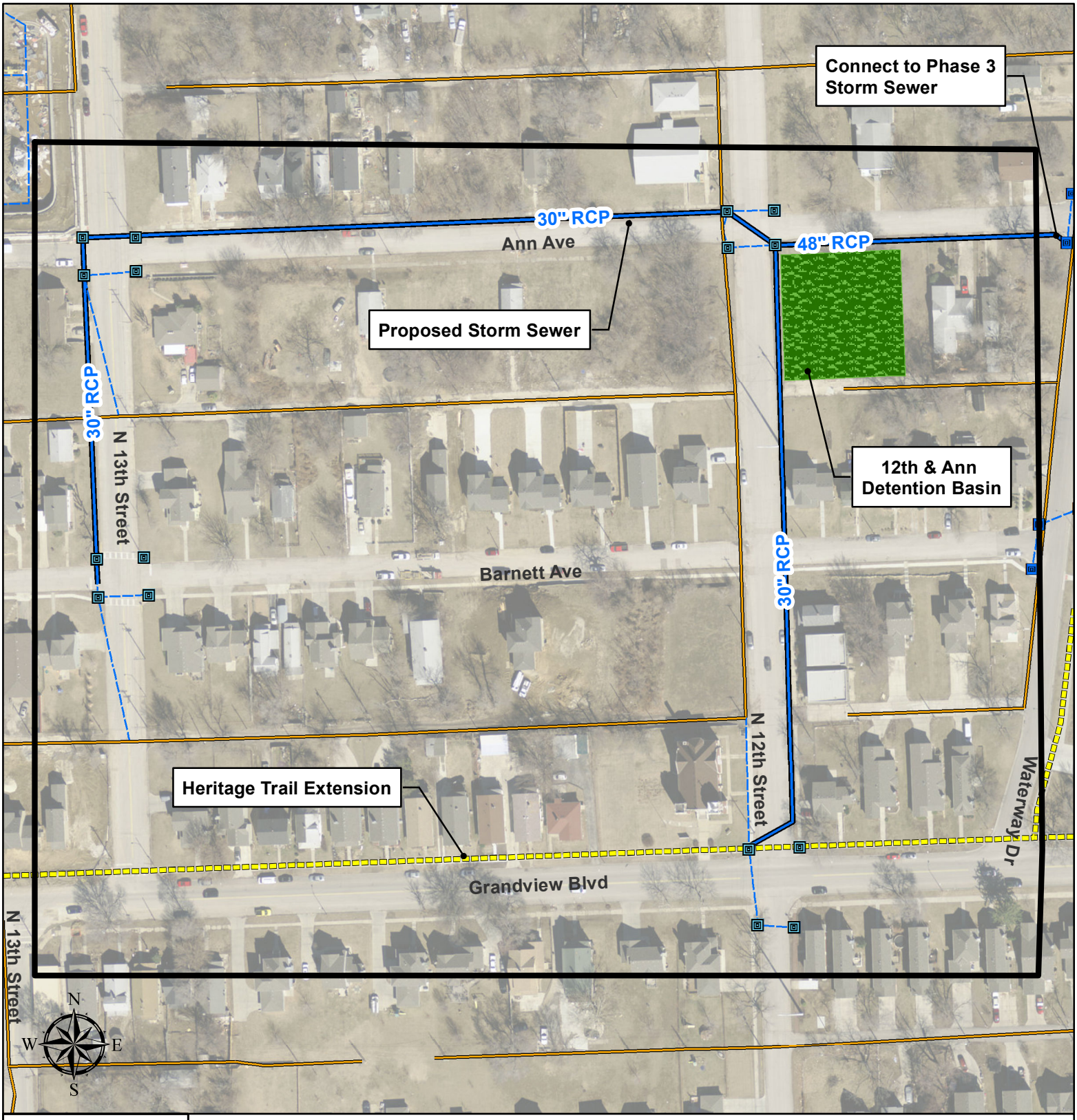

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Figure 4-14
Phase 4 Conceptual GSI Improvements

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LEGEND

- Heritage Trail Extension
- New Storm Inlet
- Proposed Storm Sewer
- Detention
- Existing Storm Inlet
- Existing Storm Sewer
- Existing Combined Sewer

0 70 140 210 280 Feet

5.0 EXISTING RESOURCES SCREENING

The multi-phase project is designed to reduce combined sewer overflow, enhance existing park resources, expand on existing GSI and storm sewer infrastructure investments, provide additional stormwater management, and improve water quality in Big Eleven lake and Jersey Creek. As part of this conceptual design, the following resources were evaluated for potential impact of or integration with the proposed improvements.

5.1 Existing Separate and Combined Sewer

The existing combined sewer interceptor runs north along N 11th Street and turns east along Washington Boulevard, where it continues along N 10th Street to Freeman Avenue, and down N 9th Street to Jersey Creek. Several portions of the project area have inlets draining to segments of separate storm pipe that eventually connect to the combined sewer. Having these storm sewer segments in place allows for a more economical approach to strategic separation if the condition allows for re-use of the existing infrastructure. The condition of these existing storm infrastructure separation areas is currently being evaluated by Water Pollution Control.

The existing stormwater and combined sewer capacity for the project area was evaluated to understand the existing stormwater conveyance level of service and to design the proposed storm sewer to meet or exceed the current conditions. For this evaluation, segments of the primary existing combined sewer were evaluated, as identified on **Figure 5-1**. This analysis found that a majority of the project area currently has a 1-year or lower level of service. Table 5-1 summarizes the pipe alignments evaluated and the resultant level of service.

Table 5-1: Existing Sewer Level of Service

Facility ID	Location	Level of Service
063650-063115	Waterway Dr. & Washington Blvd.	10-Year
063114-063112	N 11th St. & State Ave.	WQv
062559-062526	Alleyway between Armstrong Ave. & Minnesota	1-Year
062760-062761	Northeast corner of Waterway Park	WQv
075050-075049	N 12th Street between Ann Ave. & Armstrong Ave.	< WQv

Rainfall intensities based on Young & McEnroe, 2002 for 5-, 15- and 30-minute durations.
Time of concentration assumptions were based on drainage area size as follows: drainage area ≤ 5 acres assumed 5-minute; 5 acres < drainage area ≤ 20 acres assumed 15-minute; drainage area > 20 acres assumed 30-minute.

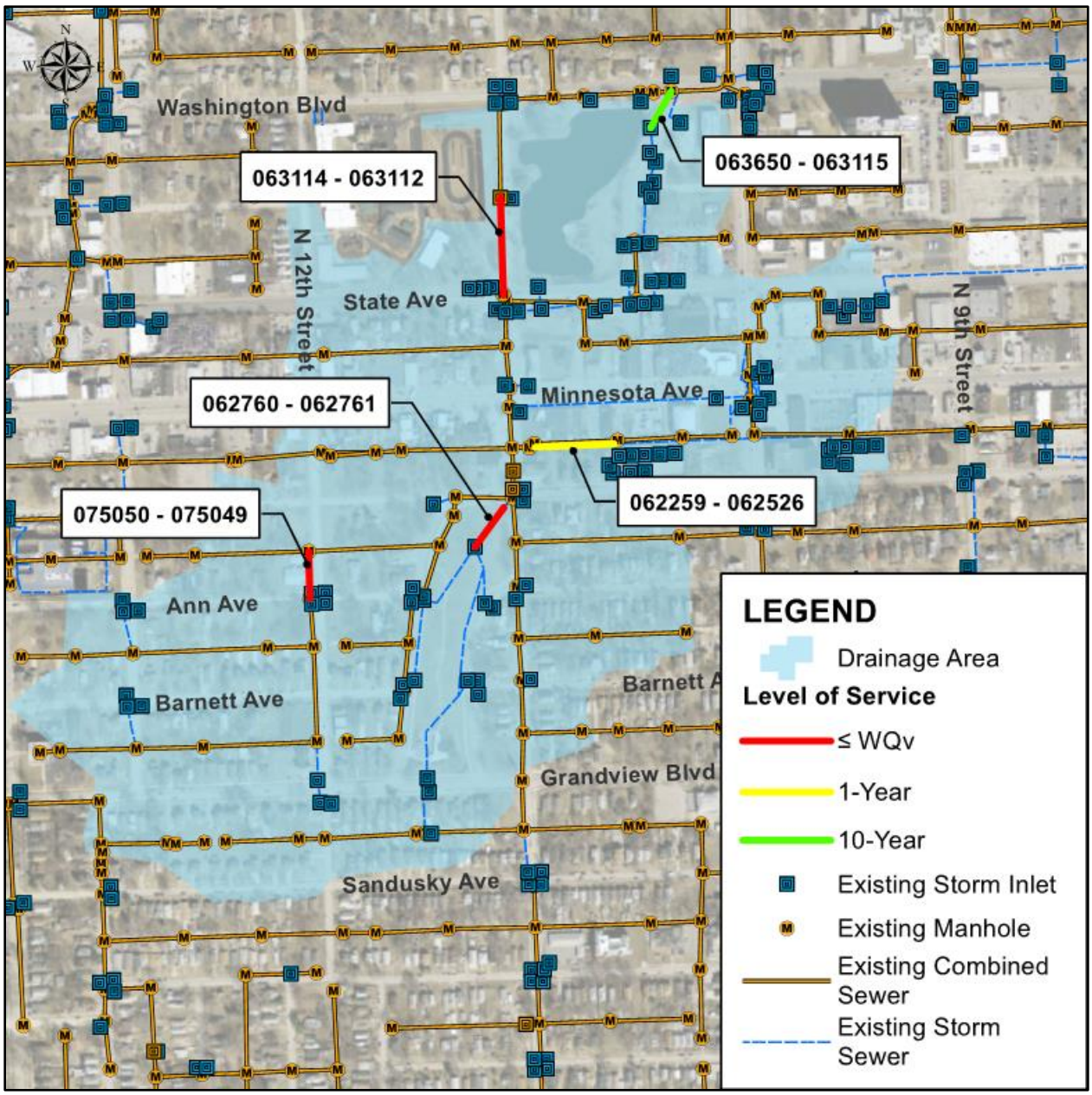


Figure 5-1: Existing Level of Service Evaluation

5.2 Potential Utility Conflicts

During field investigations it was noted that several utilities appeared to be located within the right of way along N 11th Street. Typically, all utilities other than the Board of Public Utilities (BPU) are required to relocate without compensation per the UG's current utility relocation policy in the right of way. The relocation policy for BPU utilities in the right of way is dependent on funding and relocation purposes at the direction of the UG Project Manager. To identify potential conflicts, the project team requested utility data from local utility companies for the

project area. Information was provided by the following utilities, and potential challenges to be addressed during preliminary design are identified:

- Water (BPU): Waterlines are in the right of way for almost every street in the project area. A water main appears to be located on the west side of the N 11th Street right of way which will need to be considered when finalizing the separate storm sewer alignment. Water mains also extend on both the north and south sides of Minnesota Avenue between N 10th Street and N 11th Street, portions of which may lie within proposed streetscape GSI. Additional detail on age, size, and location of the waterlines should be evaluated during the next phase of design. See Appendix B.1 for BPU waterline utility information.
- Electric (BPU): Mapping information for the N 11th Street corridor, provided by BPU, identifies a large underground electric utility duct in the right of way. The underground electric utility duct will be a major crossing consideration where the proposed storm sewer will most likely be routed underneath the duct. Approximate depths are shown in the BPU maps; however, these depths will need to be field verified in the next phase of design. See Appendix B.2 for BPU electric utility information
- Traffic Signals: There are traffic signals at the intersections of N 10th Street and Minnesota Avenue, N 10th Street and State Avenue, and N 11th Street and State Avenue that may impact the proposed storm sewer alignment and/or GSI subsurface configuration. See Appendix B.3 for Traffic Signal information.
- Gas: Kansas Gas Services has provided information for gas lines in the project area. According to gas mapping, there are no gas utilities on N 11th Street, between Armstrong Avenue and Washington Boulevard. Although N 11th Street is not a major gas utility corridor and does not impact the primary storm sewer alignment, there are gas lines that may impact the construction of the smaller storm sewers located along other street alignments. Kansas Gas Services maps for the project area can be found in Appendix B.4.
- Telecommunications: N 11th Street is a major utility corridor for AT&T telecommunications. AT&T has multiple ducts along N 11th Street. Potholing must be performed to determine the actual size and location of the existing utilities. See Appendix B.5 for approximate AT&T utility information.

5.3 Parks & Existing Vegetation

Preserving and integrating with the historic significance and features of the parks is a priority of the Unified Green project. Big Eleven Lake Park is characterized by the historic stone walls that are found throughout downtown Kansas City, Kansas. The stone walls surrounding Big Eleven Lake are planted with ornamentals and shrubs that are somewhat overgrown with undesired vegetation. Cattails are also beginning to invade the waterline of Big Eleven Lake at the southwestern edge. Phase 2 improvements to Big Eleven Lake can include cleaning out the overgrowth and cattails in the lake as well as a repairing and expanding the historic stone walls. Native species, complemented with ornamentals, can be planted in the pretreatment forebay and along the perimeter of Big Eleven Lake to enhance the vegetation in the park.

Waterway Park has recently undergone improvements to sidewalk connections and ramps. The project proposes to expand the sidewalk connections north to Big Eleven Lake Park, creating a connected corridor between the parks. The existing GSI within Waterway Park currently has some issues with erosion and vegetation, likely due to minimal stormwater being routed to them. Phase 3 proposes retrofitting the existing GSI to improve functionality and aesthetics to optimize the existing investment in these features.

5.4 Transportation

Several streets within the project area function as primary transportation corridors and are currently characterized by wide sections of pavement and on-street parking with limited designations for traffic, parking, and pedestrian zones. The proposed green streetscape improvements provide more defined parking areas as well as safer pedestrian crossing zones with intersection bump-outs. They also align with streetscape parameters identified as part of the Healthy Campus Plan and the Downtown Master Plan (UG Urban Planning & Land Use, 2007), as adopted by the UG.

There are two bus stops at the intersection of N 11th Street and Minnesota Avenue, one at the northeast corner and one at the southwest corner. There are two additional bus stops at the intersection of N 10th Street and Minnesota Avenue. Level boarding and adjustments to the bioretention bump-outs can be incorporated into the green streetscape design to accommodate the bus stops.

6.0 PROJECT CONCEPTUAL DESIGN PARAMETERS

The Unified Green project provides treatment and storage of the water quality volume (1.37-inch rainfall event) for the entire 114-acre drainage area. Storm separation of the area and retrofit of Big Eleven Lake also provides the opportunity for increased stormwater level of service and temporary stormwater storage at Big Eleven Lake Park. Total runoff volumes for the project area and therefore targeted storage volumes for Big Eleven Lake were calculated using a HEC-HMS model, and are summarized in **Table 6-1**.

Table 6-1: Total Drainage Area Runoff Volumes

Design Storm	Rainfall Depth (inches)[1]	Runoff Volume (acre-feet)[2]
WQv[3]	1.37	6.65
2-year, 24-hour	3.55	20.9
5-year, 24-hour	4.50	28
10-year, 24-hour	5.25	34
25-year, 24-hour	6.28	42.4
50-year, 24-hour	7.10	49.2
100-year, 24-hour	7.94	56.4

[1] Rainfall depths from Young & McEnroe (2002), with the exception of the Water Quality Volume
[2] Runoff volumes calculated using SCS Curve Number method assuming 51% impervious area and curve number of 65 to represent pervious area, and 25-minute lag time.
[3] Water quality design storm runoff depth and volume per MARC BMP Manual (2012).

Sizing and control of the proposed improvements are dependent on the desired level of service and associated runoff volumes. Conceptual design parameters for various level of service scenarios are further discussed in the following sections.

6.1 Big Eleven Lake Inundation Area

Because Big Eleven Lake is in the natural drainage path, larger storm control can be provided with a modified outlet control structure and limited modifications to grading and park features. Big Eleven Lake Park currently has capacity to temporarily store up to the 100-year runoff volume for the project drainage area. Depending on the stormwater level of service that is desired, Big Eleven Lake could be temporarily inundated following storm events, then dewatered to the combined sewer. The maximum outflow from the lake is limited by the capacity of the downstream combined sewer system, which is estimated to be approximately 100 cubic-feet per second. The outlet structure could be designed to store and slowly release CSO storm events to the CSS at a rate that limits the potential for a CSO event, and thereby reduces CSOs to Jersey Creek. Depending on the desired level of service, larger rain events beyond the CSO

storms could also be stored and discharged to the CSS to provide additional flood control benefit. For all events, inundation area outside the permanent pool levels can be designed to dewater in 24 hours or less so that the park would only be inundated during and shortly after larger rain events.

Big Eleven Lake storage and outflow was modeled using HEC-HMS to approximate water surface elevations for each design storm presented in **Table 6-1**. **Table 6-2** shows the calculated water surface elevations for the varying design storms. **Figure 6-1** demonstrates the approximate inundation areas for Big Eleven Lake based on the calculated water surface elevations and existing topography of the land surrounding the lake.

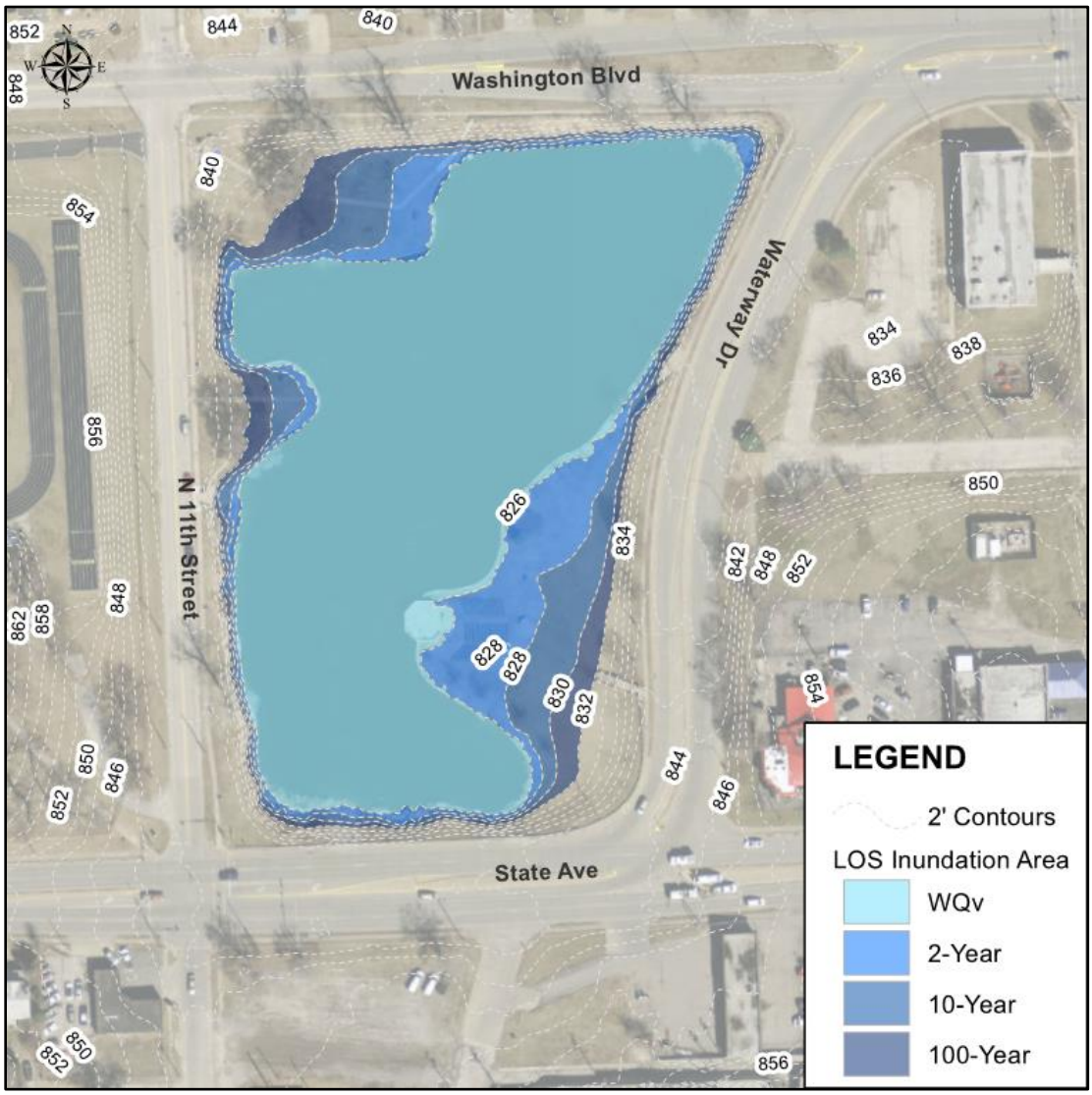


Figure 6-1: Big Eleven Lake Inundation Mapping

Table 6-2: Big Eleven Lake Water Surface Elevations

Design Storm	Water Surface Elevation (feet)
WQv	826.0
2-year	828.2
5-year	829.1
10-year	829.9
25-year	830.8
50-year	831.5
100-year	832.2

The inundation mapping assumes that the current permanent pool in Big Eleven lake is at elevation 825 feet. The water quality volume inundation area assumes runoff volume for 24.5 acres of the total area, which represents the portions of the 114-acre drainage area that are not controlled by upstream GSI facilities. This water quality volume can be stored within the existing footprint of Big Eleven Lake Park extents, assuming a reinforced concrete cap is constructed to raise the existing lake edge 6 inches. The 2-, 10-, and 100-year inundation areas assume the entire 114-acre drainage area upstream, as these larger storm events will not be routed through or controlled by upstream GSI.

Inundation areas are based on 2-foot contours derived from Light Detection and Ranging (LIDAR) data. Additional survey of Big Eleven Lake Park will be needed in the next phases of design to better define inundation extents. Additional stormwater modeling would also be needed to simulate the stormwater conveyance, storage and discharge.

The use of Opti Real Time Controls further enhances the ability to control the water level in Big Eleven Lake and potentially reduce the inundation area when significant rainfall is forecasted. Water budget calculations are recommended in future stages of design when more is known about the suspected spring feeding Big Eleven Lake.

6.2 Storm Sewer Level of Service

Given the storage availability at Big Eleven Lake, UG has flexibility in determining the desired storm sewer level of service. The proposed storm pipes were sized for level of service scenarios including the water quality volume, 1-, 2-, 5-, 10-, and 25-year scenarios. Pipe sizes required to accommodate each scenario are summarized in

Table 6-3. To improve on the current storm sewer level of service that is provided by the existing combined sewer system and account for minimal differences in pipe size required to achieve those levels, it is recommended to provide a 2- to 5-year level of conveyance service for the separate storm system to provide sustainable stormwater management in the CSS areas. When traditional conveyance is used in conjunction with green stormwater infrastructure and reductions in impervious area, the actual level of service recognized typically exceeds that of the traditional stormwater conveyance system. Up to a 25-year level of service can be provided with increase to pipe sizes and larger inundation area in Big Eleven Lake.

Table 6-3: Proposed Level of Service Pipe Sizes

Level of Service	Intensity (inches/hour)[1]	Pipe Size Range (inches)
WQv	1.90	15 – 48
1-year	3.96	21 – 60
2-Year	4.92	21 – 72
5-year	6.23	24 – 72
10-year	7.27	24 – 72
25-year	8.70	30 – 84

[1]Young & McEnroe, 2002 assuming 5-minute time of concentration

6.3 Green Stormwater Infrastructure Sizing & Storage

The proposed GSI discussed in each phase were conceptually sized based on the drainage area and impervious area tributary to the facility as well as an assumed GSI type, surface area, and standard cross section at that location. **Figure 6-2** illustrates the drainage areas treated by each GSI and the drainage area tributary to Big Eleven Lake.

Sizing of the GSI was based on capturing and storing the water quality volume for the 1.37-inch storm within the available storage space. The primary GSI types evaluated include bioretention/bioswale, permeable pavements, and detention. Bioretention assumed available storage within the ponding area and the void space within the soil and aggregate media (if applicable). Permeable pavement calculations assumed storage capacity within the aggregate void space and detention assumed storage within the ponding area. The following porosities were assumed throughout these calculations:

- Bioretention soil media porosity of 0.30
- Aggregate storage media porosity of 0.40

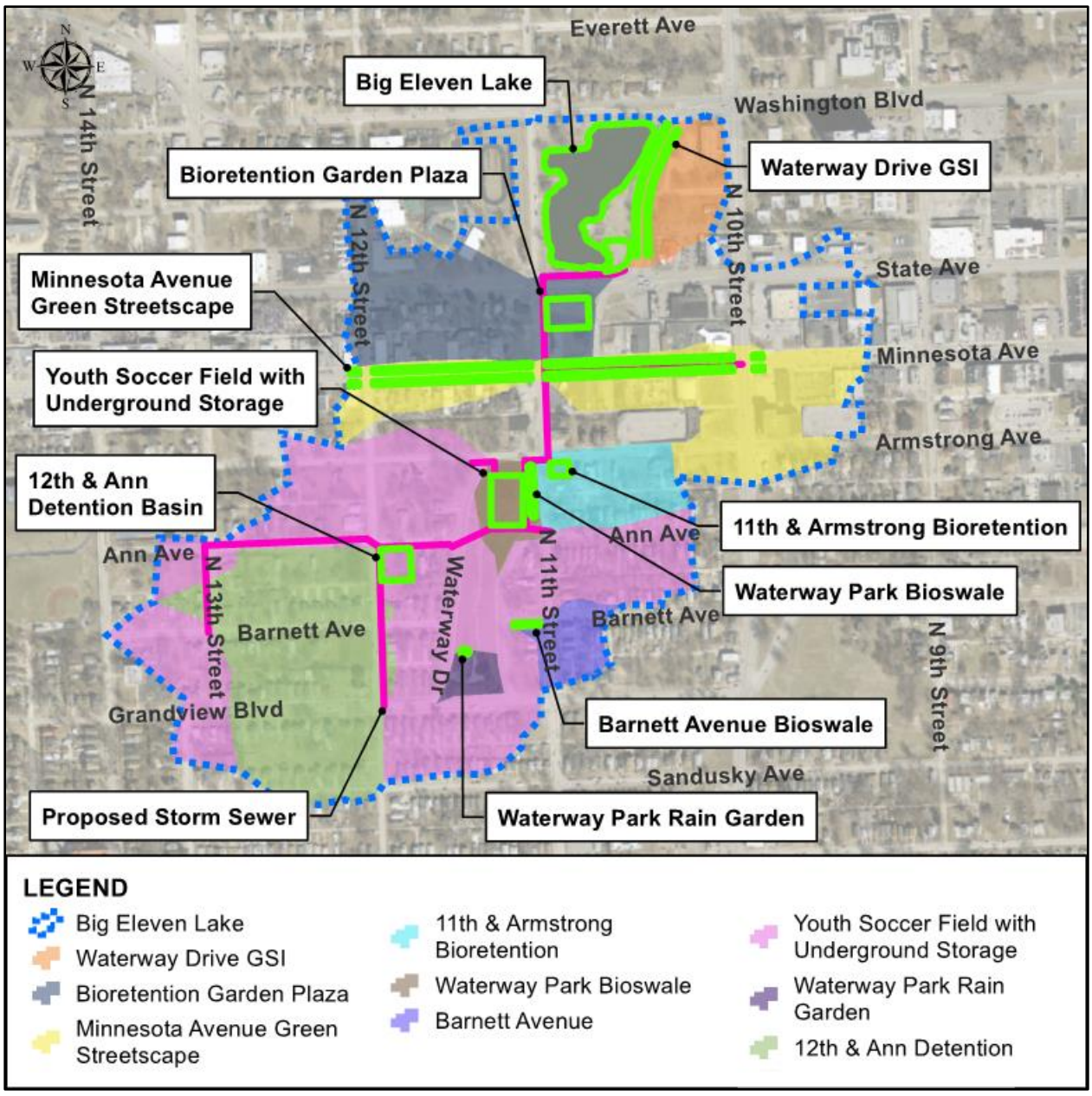


Figure 6-2: GSI Drainage Areas

The following sections summarize the GSI facilities proposed in each phase, the associated water quality volume controlled, and the storage volume provided.

6.3.1 Phase 1

Phase 1 GSI includes a bioretention garden plaza and a green streetscape that features permeable pavement parking areas, delineated by bioretention bump-outs. The stormwater management features in Phase 1 provide approximately 2.68 acre-feet of total storage for the water quality volume runoff from the 25.27-acre drainage area.

Table 6-4 summarizes the available storage and associated water quality volume for the proposed GSI in Phase 1.

Table 6-4: Phase 1 Storage and Runoff for Water Quality Volume

Proposed GSI Feature	GSI Plan Area (acre)	Storage Volume (acre-feet)	Drainage Area (acre)	Impervious (%)	WQv (acre-feet)
Bioretention Garden Plaza	0.51	0.84	10.86	64	0.78
Minnesota Avenue Green Streetscape	1.12	1.43	14.41	83	1.31
Total	1.63	2.27	25.27	75	2.09

Parameters assumed for storage of the water quality volume within the GSI are summarized below.

- Bioretention Garden Plaza:
  - Ponding depth: 6 inches
  - Bioretention soil media depth: 30 inches
  - Aggregate storage media depth: 12 inches
- Minnesota Avenue Green Streetscape:
  - Bioretention
    - Ponding depth: 6 inches
    - Bioretention soil media depth: 30 inches
    - Aggregate storage media depth: 12 inches
  - Permeable Pavement
    - Aggregate storage media depth: 36 inches

6.3.2 Phase 2

Phase 2 includes retrofitting the Big Eleven Lake outlet structure and including Opti RTC, a pretreatment forebay for Big Eleven Lake, and bioretention and permeable pavement parking on Waterway Drive. The stormwater management features in Phase 2 provide approximately 2.35 acre-feet of storage for the water quality volume runoff, from the 28.89-acre drainage area. As discussed in Section 6.1, the target water quality storage volume for Big Eleven Lake was calculated as the total upstream tributary area not treated by an upstream GSI facility. The lake and pretreatment forebay provide storage for the water quality volume between the permanent pool elevation and a 6-inch concrete cap on the existing stone wall around the perimeter of the

lake. **Table 6-5** summarizes the storage and runoff volumes for the control of the water quality storm for Phase 2 improvements.

Table 6-5: Phase 2 Storage and Runoff for Water Quality Volume

Proposed GSI Feature	GSI Plan Area (acre)	Storage Volume (acre-feet)	Drainage Area (acre)	Impervious (%)	WQv (acre-feet)
Big Eleven Lake & Pretreatment Forebay	3.83	2.04[1]	24.52	56	1.55
Waterway Drive GSI	0.32	0.31	4.37	57	0.28
Total	4.15	2.35	28.89[2]	56	1.83

[1]Reported storage volume represents available pretreatment forebay storage volume and Big Eleven Lake storage below 6-inch reinforced concrete cap. Total available storage for Big Eleven Lake is Summarized in Table 6-6.
[2]Drainage area represents targeted area for water quality volume storage only.

For storm events greater than the water quality volume targeted storage in Big Eleven Lake assumes runoff from the entire 114-acre project drainage area because upstream GSI is only designed to control the water quality volume, and therefore any larger storm flows will be routed directly to Big Eleven Lake. Parameters assumed for storage of the water quality volume within Waterway Drive GSI and larger storm storage for Big Eleven Lake include:

- Big Eleven Lake & Pretreatment Forebay: provides storage within the lake and forebay areas above the permanent water level. As discussed in Section 6.1, the total storage volume of Big Eleven Lake is dependent on the stormwater level of service that is desired. **Table 6-6** shows the approximate water surface elevations and available storage for the varying level of service options. Approximate level of service was rounded to the nearest 1 foot.

Table 6-6: Big Eleven Lake Available Storage

Stage (feet)	Storage[1] (acre-feet)	Approximate Level of Service
825	0.0	-
826	2.04[2]	WQv
827	5.54	-
828	9.65	2-Year
829	14.06	5-Year
830	18.73	10-Year
831	23.63	25-Year
832	28.70	100-Year

833	33.94	
834	39.33	
[1]Stage-storage is based 2-foot contours from LIDAR. The intermediate contours were derived from linear interpolation to approximate the level of service. [2]Water quality volume storage assumed 1.79 acre-feet of storage below the 826-foot elevation plus an additional 0.25 acre-feet of storage in the pretreatment forebay.		

- Waterway Drive GSI:
  - Bioretention
    - Ponding depth: 6 inches
    - Bioretention soil media depth: 30 inches
  - Permeable Pavement
    - Aggregate storage media depth: 24 inches

6.3.3 Phase 3

Phase 3 features new bioretention, bioswale, and underground storage, as well as improvements to the existing rain garden and bioswale in Waterway Park. The stormwater management features in Phase 3 provide approximately 2.09 acre-feet of storage for the water quality runoff volume from the 42.84-acre drainage area. **Table 6-7** summarizes the storage and runoff volumes for the control of the water quality storm.

Table 6-7: Phase 3 Storage and Runoff for Water Quality Volume

Proposed GSI Feature	GSI Plan Area (acre)	Storage Volume (acre-feet)	Drainage Area (acre)	Impervious (%)	WQv (acre-feet)
11th & Armstrong Bioretention	0.1	0.26	4.44	49	0.25
Barnett Avenue Bioswale	0.04	0.06	2.23	50	0.13
Youth Soccer Field with Underground Storage	0.66	1.61	33.15	41	1.59
Waterway Park Rain Garden	0.01	0.03	0.92	22	0.03
Waterway Park Bioswale	0.11	0.13	2.10	7	0.03
Total	0.92	2.09	42.84	40	2.03

Parameters assumed for storage of the water quality volume within the GSI are summarized below.

- 11th & Armstrong Bioretention:
  - Ponding depth: 12 inches
  - Bioretention soil media depth: 36 inches
  - Aggregate storage media depth: 18 inches
- Barnett Avenue Bioswale:
  - Ponding depth: 6 inches
  - Bioretention soil media depth: 30 inches
  - Aggregate storage media depth: 12 inches
- Youth Soccer Field with Underground Storage:
  - ADS StormTech SC-740 available storage
  - Additional aggregate storage depth (over ADS StormTech aggregate): 3 inches
- Waterway Park Rain Garden:
  - Ponding depth: 9 inches
  - Bioretention soil media depth: 30 inches
  - Aggregate storage media depth: 12 inches
- Waterway Park Bioswale:
  - Ponding depth: 6 inches
  - Bioretention soil media depth: 30 inches

6.3.4 Phase 4

Phase 4 GSI improvements include a detention basin, which relies on open area volume to provide 0.78 acre-feet of stormwater storage in an assumed 2-foot ponding depth. **Table 6-8** summarizes the target water quality volume and available storage at the proposed site. GSI section assumptions include:

- 12th & Ann Detention:
  - Ponding depth: 24 inches

Table 6-8: Phase 4 Storage and Runoff for Water Quality Volume

Proposed GSI Feature	GSI Plan Area (acre)	Storage Volume (acre-feet)	Drainage Area (acre)	Impervious (%)	WQv (acre-feet)
12th & Ann Detention	0.39	0.78	16.72	36	0.72

7.0 PROJECT BENEFITS

While the primary focus of the Unified Green project is to implement and demonstrate GSI practices as part of an integrated approach to reduce CSO volume, multiple ancillary benefits for the community are extracted. These benefits correlate with adopted UG plans by the Parks and Recreation and the Urban Planning and Land Use departments. Additionally, community leaders continue to seek and identify opportunities to leverage UG funding mechanisms in a manner that provides the biggest impact to the community. These ancillary benefits are described in the following sections, and can be used to begin the GSI conversation with decision makers and residents.

7.1 Reduce Stormwater to Priority Outfall

The Unified Green project will reduce CSO volume and frequency at CSO 19 (064-019) shown on **Figure 1-1**, provide flood control benefit, and improve water quality through use of green stormwater infrastructure. Unified Green will manage CSO volumes per the Draft Integrated Overflow Control Plan (Burns & McDonnell, 2016) upstream of and within Big Eleven Lake. Proposed improvements will infiltrate stormwater for the most frequent rain events, and detain stormwater at Big Eleven Lake until capacity becomes available in the downstream combined sewer system. Based on preliminary modeling done during the IOCP, the reduction of CSO with GSI is 83.2% at CSO 19 with 6 overflow events based on the 2001 Design Storm as defined in the Sewer Evaluation Work Plan (Burns & McDonnell, 2013). Additional improvements north of Big Eleven Lake may also be needed to address overflow volume at CSO 19.

7.2 Enhance and Connect Parks

Visitors walking the perimeter trail at Waterway Park can see Big Eleven Lake to the north. The connection between these two parks was part of a larger vision at the turn of the century (**Figure 7-1**), of which now are present-day Big Eleven Lake Park and Waterway Park. Each present-day park provides unique amenities, integrating the rich history of the Parks system in the UG with the current desires of its residents. Additionally, this connection follows a vision for an extension of the Riverfront Heritage Trail System, as proposed in the Downton Master Plan. Improving the visual and pedestrian connection between Waterway Park and Big Eleven Lake Park will encourage interaction with the surrounding neighborhoods and promote business opportunities adjacent to the corridor.

Enhancements at Big Eleven Lake Park currently include extending the existing stone walls along the southeastern portions of the site for a stormwater quality and quantity control function. This extension presents an opportunity to repair the existing stone walls as needed, remove undesired vegetation, and replant the stone walls with new vegetation. Additionally, there is an opportunity to designate parking for park users through the proposed bioretention bump-outs and permeable paver parking areas aligning Waterway Drive. Creating this parking is an added benefit for users of the Beatrice L. Lee Community Center and could promote a natural connection of the Community Center to Big Eleven Lake as was identified in the Parks Master Plan (UG Parks & Recreation Department, 2017), while providing an added stormwater management and CSO reduction benefit to the watershed.

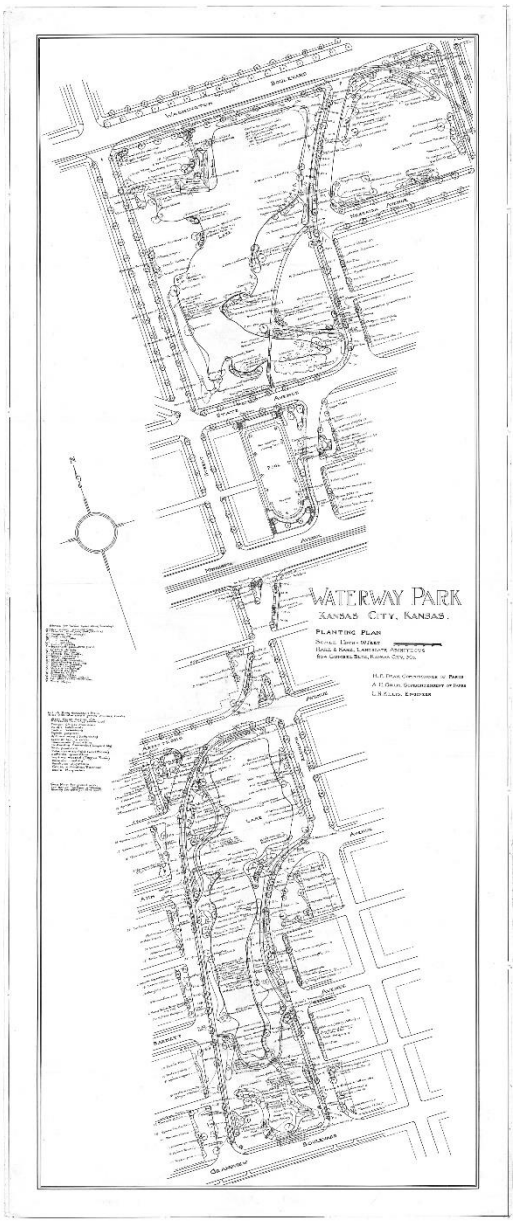


Figure 7-1: Historical Corridor from Waterway Park to Big Eleven Lake (Kansas City, KS)

7.3 Define the Roadway Cross Section

The proposed GSI for Minnesota Avenue is an opportunity to create and clearly identify uses within the existing road cross section, including pedestrian crossing and designated parking areas. Pedestrian crossings integrated with GSI bump-outs will improve pedestrian safety by creating clearly defined pedestrian crossing zones and decreasing pedestrian crossing distances between N 10th Street and N 12th Street along Minnesota Avenue. **Figure 7-2** shows the existing cross section. In addition to collecting stormwater and reducing pedestrian crossing distances, these bump-outs will clearly delineate the existing angled parking within the roadway cross section. Permeable pavers installed within the angled parking width create a visual designation of the parking area while providing another point of stormwater collection and infiltration.

Figure 7-2: Existing Minnesota Avenue Roadway Cross Section
(© 2017 Google; N 11th Street & Minnesota Avenue Viewing East, Kansas City, KS)

7.4 Align with Community Plans

Proposed improvements align with adopted UG plans including the IOCP, the Healthy Campus Plan, Downtown Master Plan, and the Parks Master Plan. Street, sidewalk, parking, and other at-grade infrastructure improvements identified in these plans can also have a primary stormwater function in addition to aesthetic and traffic definition benefits. By integrating features from multiple planning efforts, the Unified Green project has the opportunity to maximize the community benefit while minimizing cost and disturbance from construction activities.

The IOCP prioritizes the implementation of GSI within the Big Eleven Lake watershed. This GSI project is a visible investment in an environmental justice neighborhood taking advantaged of City-owned and vacant properties. The project will improve the water quality of Big Eleven Lake, which is a highly used park with the urban core. IOCP was developed with input from a community task force selected to represent disadvantaged citizens within UG.

The inclusion of GSI in the project area aligns with the Healthy Campus Plan objectives of creating more green spaces, connecting public spaces, and re-investing in the urban core. The pedestrian connection proposed as part of the Healthy Campus Plan follows natural drainage paths within the watershed, integrating the Healthy Campus Plan easily with stormwater management objectives. This integration should continue to be explored through future implementation of the Healthy Campus Plan (**Figure 7-3**).

Figure 7-3: Minnesota Avenue Reconfigured
UG Urban Planning & Land Use, 2014, p. 25

The Unified Green concept also aligns with values in the Downtown Master Plan (**Figure 7-4**): History of Place, Community Assets, Connections, and Safety and Image. The pretreatment forebay at Big Eleven Lake Park incorporates architectural assets that mimic historical architectural components significant to downtown Kansas City, Kansas. The green stormwater infrastructure enhances recreational community assets at Waterway Park and Big Eleven Lake. The bioretention garden plaza could extend a portion of the Heritage Trail per the Downtown Master Plan and provide pedestrian access to the Healthy Campus Plan as well as access to bus stops at N 11th Street and Minnesota Avenue. Proposed stormwater improvements to the Minnesota Avenue, Waterway Drive, and N 11th Street corridors will provide connections between downtown and adjacent neighborhoods, encourage multi-modal transportation through access to pedestrian zones, bus stops, and defined parking areas, and revitalize this portion of downtown.

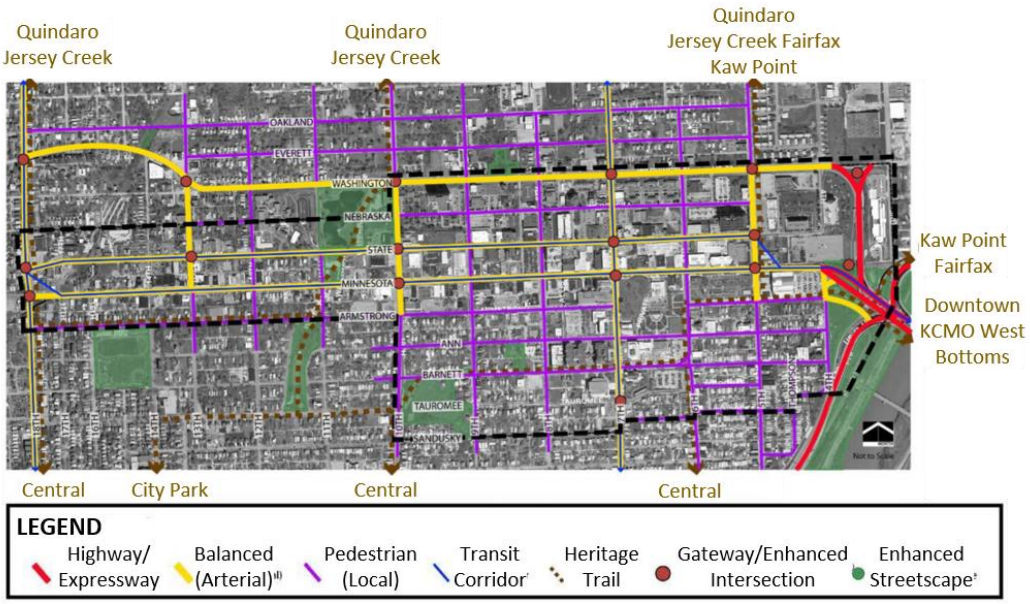


Figure 7-4: Mobility Framework as Depicted in Downtown Master Plan
(UG Urban Planning & Land Use, 2007, p. I-15)

The Parks Master Plan (adopted 2017) includes public input and professional assessment of both Big Eleven Lake and Waterway Park. Recommendations at Big Eleven Lake includes:

- Vacating Waterway Drive (**Figure 7-5**) to improve access, connectivity, and usability. Proposed stormwater features as part of Unified Green can integrate into either closing portions of Waterway Drive or repurposing Waterway Drive as parking.
- Replant native wetland species around Big Eleven Lake. This recommendation would integrate well with reconnecting the stormwater function at the southeast corner of Big Eleven Lake and improving water quality.
- Replant and repair stone planting beds around Big Eleven Lake. The extension of the stone walls and planting beds on the south side of Big Eleven Lake as part of re-establishing the stormwater connection could promote restoration activities around the lake's perimeter (**Figure 7-6**).

Figure 7-5: Existing Waterway Drive Adjacent to Big Eleven Lake
(Waterway Drive & Washington Boulevard Viewing South, Kansas City, KS)

Figure 7-6: Existing Stone Wall at South Edge of Big Eleven Lake
(Big Eleven Lake Park, Kansas City, KS)

The Parks Master Plan Recommendations at Waterway Park included:

- Reseed grass on the soccer field. Installation of dedicated stormwater infiltration facilities below the existing soccer field allows for the re-grading and definition a youth soccer field. Perforated pipe drainage systems associated with the infiltration facilities could help drain the surface of the soccer fields.
- Re-vegetate non-play areas with short-grass natives to assist with stormwater management. Retrofitting existing outlet structures and amending the existing soil adjacent to the parking lot and at the northeast corner of the park will promote infiltration in existing rain garden areas (**Figure 7-7**).

Figure 7-7: Existing Bioswale at Waterway Park
(Waterway Park, Kansas City, KS)

7.5 Promote Economic Development and Environmental Justice through Improved Infrastructure

Currently, the project site and surrounding area tributary to Jersey Creek is largely characterized by vacancy, as shown on **Figure 7-8**. The sewer, street, sidewalk, and GSI improvements in Big Eleven Lake Park, Waterway Park, and along State Avenue, Minnesota Avenue, and N 11th Street will make the area more desirable for businesses along these corridors and for the neighborhoods near Waterway Park.

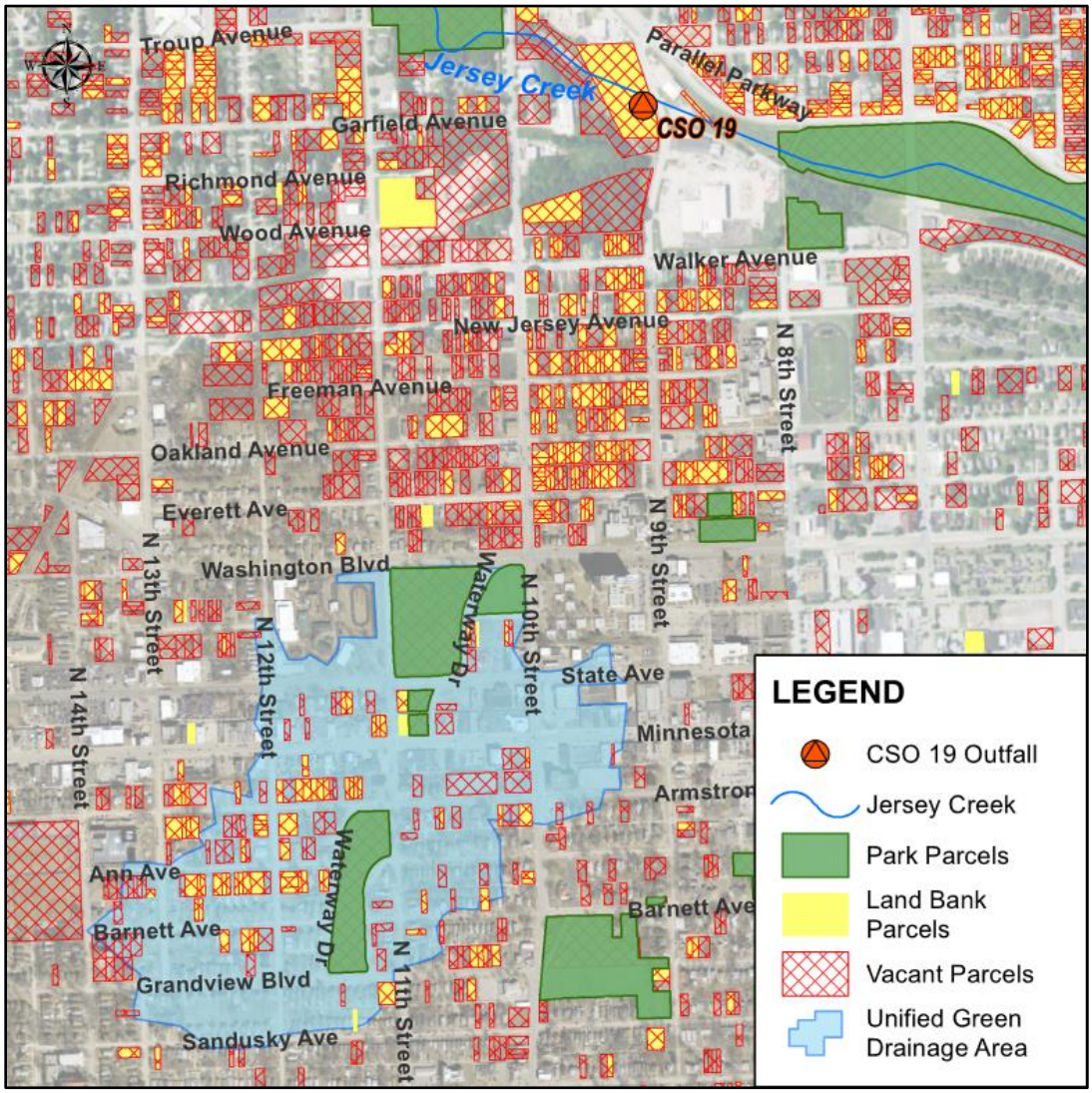


Figure 7-8: Land Bank and Vacant Parcels

Unified Green embodies the EPA's overarching strategy for environmental justice. The pedestrian access to the Healthy Campus Plan site, parks, and community center, as well as GSI improvements for CSO control improve and promote the health and environment of this

community. The opportunity to enhance the urban landscape with multi-benefit infrastructure can establish a partnership precedent between the UG and community investors. The Unified Green project provides an opportunity to evaluate GSI practices in strategically planned environments as a catalyst for urban revitalization. It offers an opportunity to holistically invest in a community's infrastructure looking at-grade and below the surface, and identifying future opportunities and processes for continued infrastructure investments to 'grow' the UG 'green.'

7.6 Educate the Community

Integrated planning for combined and separate sewer systems includes public education. The bioretention garden plaza at west side of what will likely be the first phase of the Healthy Campus Plan will provide an opportunity for education and outreach to the community related to the historic significance of the sunken gardens at this site, the original park plan for Kansas City, water quality, and stormwater management. Education can consist of permanent signage that shows the integration and the historical significance of the corridor with stormwater management of the future through GSI. The features incorporated in Phase 1 can then be expanded throughout the Unified Green corridor to provide community edification of the UG's investment in infrastructure and health.

7.7 Pilot Green Stormwater Infrastructure Construction, Maintenance and Monitoring

The diverse palette of GSI types and technologies proposed with the Unified Green project provides UG the ideal opportunity for a green pilot project. With this pilot, UG can gain experience with design, installation, short and long-term maintenance of green stormwater infrastructure. Upon completion of the Unified Green project, monitoring will be performed to evaluate the effectiveness of the selected controls in reducing wet weather overflows in the CSS. Quantification of the capture volumes, infiltration rates, and downstream benefits will be used for future green infrastructure and long term IOCP planning. The results will be included in the Final Measures Plan. This pilot also requires a long-term operations and maintenance program of the GSI facilities, generating a need for more green jobs within UG. Kansas City, Missouri is currently in year one of implementing the Water Environment Federation (WEF) National Green Infrastructure Certification Program (NGICP), which sets a national standard for GSI construction, inspection and maintenance workers. UG has the opportunity to expand on this program and create a skilled workforce in at-risk communities, benefitting both the IOCP performance and the local economy.

8.0 OPINION OF PROBABLE COST

Burns & McDonnell has prepared a planning level Opinion of Probable Cost for the construction associated with each phase of the Unified Green project. Since Burns & McDonnell has no control over the cost of labor, material, or equipment furnished by others not under contract to Burns & McDonnell, the opinion of probable cost for construction of the work is based on experience and qualifications. Burns & McDonnell does not guarantee that proposals, bids, or actual project costs will not vary from the opinions of probable cost.

The overall cost for the Unified Green project, including all four phases of improvements, is estimated to be between $9.8 M and $10.4 M, depending on the desired level of service and GSI sites selected for construction. **Table 8-1** and **Table 8-2** summarizes the cost for each phase by categories for construction for the minimum and maximum level of service options, the WQv and 25-Year LOS, respectively; a detailed opinion of probable cost for each phase can be found in Appendix C. Primary construction categories are quantity-based and include Demolition/Restoration, Storm Sewer Construction, Green Stormwater Infrastructure Construction, and Landscaping. General construction categories include Property Acquisition, Erosion and Sediment (E&S) Control, Traffic Control, and Engineering Design. Major assumptions for development of quantities for each construction category are further discussed in the following subsections.

Table 8-1: Conceptual Opinion of Probable Cost for Unified Green Project Phasing, WQv LOS

COST SUMMARY CATEGORY	PHASE 1	PHASE 2	PHASE 3	PHASE 4
DEMOLITION/RESTORATION	$1,098,000	$254,000	$208,000	$391,000
STORM SEWER CONSTRUCTION	$422,000	$36,000	$341,000	$341,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION	$1,187,000	$558,000	$662,000	$9,000
LANDSCAPING	$248,000	$62,000	$112,000	$13,000
PROPERTY ACQUISITION	$262,000	-	$169,000	-
GENERAL CONSTRUCTION E&S Control – 5% Traffic Control – 2% Engineering Design – 15%	$650,000	$201,000	$290,000	$166,000
CONTINGENCY (25%)	$967,000	$278,000	$446,000	$230,000
TOTAL	**$4,900,000**	**$1,400,000**	**$2,300,000**	**$1,200,000**

Table 8-2: Conceptual Opinion of Probable Cost for Unified Green Project Phasing, 25-Year LOS

COST SUMMARY CATEGORY	PHASE 1	PHASE 2	PHASE 3	PHASE 4
DEMOLITION/RESTORATION	$1,098,000	$254,000	$208,000	$391,000
STORM SEWER CONSTRUCTION	$660,000	$36,000	$483,000	$402,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION	$1,187,000	$558,000	$662,000	$9,000
LANDSCAPING	$248,000	$62,000	$112,000	$13,000
PROPERTY ACQUISITION	$262,000	-	$169,000	-
GENERAL CONSTRUCTION E&S Control – 5% Traffic Control – 2% Engineering Design – 15%	$703,000	$201,000	$322,000	$179,000
CONTINGENCY (25%)	$1,040,000	$278,000	$489,000	$249,000
TOTAL	**$5,200,000**	**$1,400,000**	**$2,500,000**	**$1,300,000**

8.1 Demolition/Restoration

The following summarizes major assumptions related to the Demolition/Restoration line items presented in Appendix C.

- Building demolition was assumed to be 30% of all property acquisition cost.
- Removal all existing inlets.
- Removal and replacement of existing street pavement assuming full depth replacement in addition to mill and overlay of entire street section to provide a complete restored product for the project area.
- Removal and replacement of existing driveways, sidewalks, stairs and ADA ramps as impacted by the proposed improvement alignments only.

8.2 Storm Sewer Construction

The following summarizes major assumptions related to the Storm Sewer Construction line items presented in Appendix C.

- All storm sewer is sized assuming 25-year conveyance level of service for the maximum option and WQv level of service for the minimum option. New storm alignment includes extents shown in the detailed phase figures in Section 4.0.

- Existing storm sewer is assumed to be reused unless otherwise noted. New 15-inch storm sewer was assumed for connection of all inlets to the new storm sewer.
- Existing inlets will be removed, and new curb inlets will be strategically placed along and adjacent to the proposed storm sewer alignment.
- New stormwater manholes at vertices in proposed storm sewer alignment as well as junctions with new and existing storm sewer pipe.

8.3 Green Stormwater Infrastructure Construction

The following summarizes major assumptions related to the Landscaping line items presented in Appendix C. While green stormwater infrastructure construction is presented as an individual construction category, it is important to note that all categories listed are critical to the function of the GSI.

- Bioretention and permeable pavement quantities based on plan areas and component depths presented in Section 6.3.
- A 6-inch deep, No. 8 aggregate choker course was assumed for all bioretention GSI between soil and storage aggregate layers.
- PVC cleanouts and a 6-inch perforated underdrain were assumed for all bioretention and permeable pavement GSI.
- Green outlet structures to control flow out of GSI and maximize infiltration was assumed for all bioretention GSI.
- Geomembrane was assumed for GSI adjacent to street pavement or building subgrades.
- Ribbon curb was assumed at the interface of all permeable pavement and standard street pavement.

8.4 Landscaping

The following summarizes major assumptions related to the Landscaping line items presented in Appendix C.

- Landscaping assumptions were generally based on an assumed cost per square foot of GSI installed. Detention assumed standard sod restoration, while bioretention and bioswales assumed a mixture of native plugs and shrubs.
- Tree installation assumed replacement of existing trees removed on a 3:1 (removal to replacement) basis.

8.5 General Construction

The following summarizes major assumptions related to the general construction line items presented in Appendix C. Note all general construction costs are rounded to the nearest $1,000.

- Property acquisition cost based on assessed value plus an additional 25% presented on the Official Website of the UG of Wyandotte County and Kansas City, KS.
- Erosion and sediment control was assumed to be 5% of the subtotal of the primary construction categories (Demolition/Restoration, Storm Sewer Construction, Green Stormwater Infrastructure Construction, and Landscaping).
- Traffic control was assumed to be 2% of the subtotal of the primary construction categories.
- Engineering design was assumed to be 15% of the primary construction categories. Lake health assessment costs discussed further in Section 9.0 are assumed to be included in engineering design fees.
- Contingency was assumed to be 25% the subtotal for all construction items, primary construction categories and general construction categories.

9.0 RECOMMENDED NEXT STEPS

The conceptual design presented in this report was based on available data and information at the time of composition. To move the Unified Green concept into the next phases of pilot project implementation refer to **Figure 9-1** for an overview of major steps. Continued coordination and communication with the Board of Park Commission and other UG public improvement projects, and integration with development initiatives is critical to the overall success of the project. Of these major steps, the following should be noted from a process and implementation perspective.

- UG is currently undergoing a full inspection and review of existing structure and pipe assets within the project area. It is recommended to review and incorporate rehabilitation recommendations of existing sewer infrastructure within Unified Green project extents as part of each design phase. Analysis and construction cost for this effort is not included as part of this concept design. In addition, consideration should be given to all infrastructure at, above, and below grade that could be impacted as part of holistic redevelopment of the corridor.

- The Healthy Campus Plan submitted applications to UG's Urban Planning and Land Use Department to proceed with development between Minnesota Avenue and State Avenue, from N 10th Street west to N 11th Street. Schedule and improvements for this development project should be integrated with Unified Green to form a cohesive public improvement project, constructed at one time. Phase 1 of this project was developed to integrate with the Healthy Campus Plan, however, the improvements are able to function as stand-alone projects and can move forward even if development does not.

- Big Eleven Lake has been the focus of water quality criticism by elected officials, regulatory agencies, and others. It is recommended to complete a comprehensive lake assessment at Big Eleven Lake to analyze the existing lake's health and the proposed future condition of the lake with the introduction of a direct stormwater condition. To complete this assessment, it is recommended to complete the following major tasks: bathymetric survey; sediment probes to quantify sediment thickness; and sediment core sampling and analysis for metals, hydrocarbons, chlorides, ammonia, phosphorus, and total carbon. In addition to the water quality assessment, it is important to understand how water is currently moving into and out of the lake. Since there is very limited

tributary drainage area, but a constant water level is maintained in the lake, it is hypothesized that the lake itself is spring fed. For this reason, it recommended to install a pressure transducer to monitor water levels in the lake as well as a rain gage to associate those water levels with rainfall depths.

- In addition to the continued coordination with the Board of Park Commission, BPU, DPW, and UG public improvement projects, the Unified Green pilot project provides the opportunity for other potential partnerships including NGICP and Healthy Communities Wyandotte (HCW). Partnering with NGICP creates workforce development opportunities for GSI construction and maintenance as discussed in Section 7.7. Healthy HCW under UG Public Health Department works with several community organizations including Cultivate Kansas City and Kansas City Community Garden to promote development of urban gardens within UG. Integration of GSI into the community supports the goals of both organizations, and creates the potential for strong partnership opportunities with the NGICP, HCW and their affiliates.

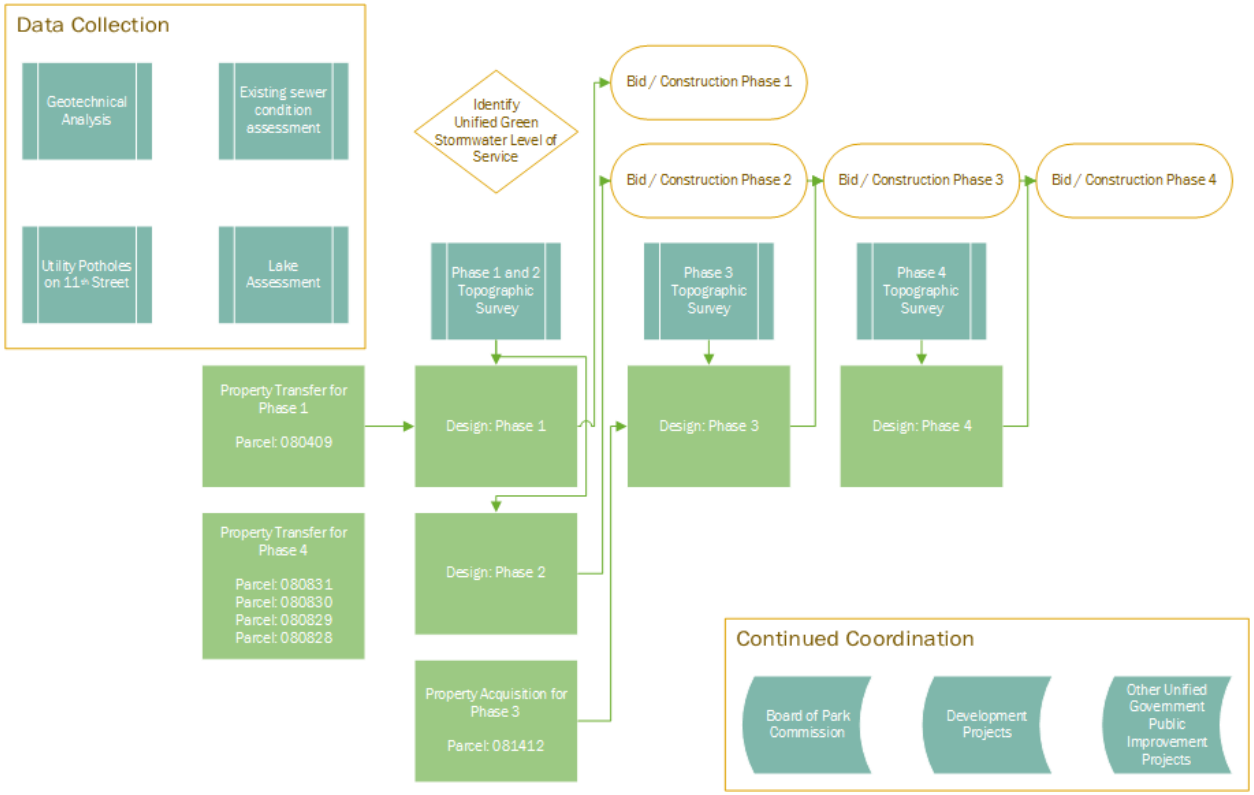
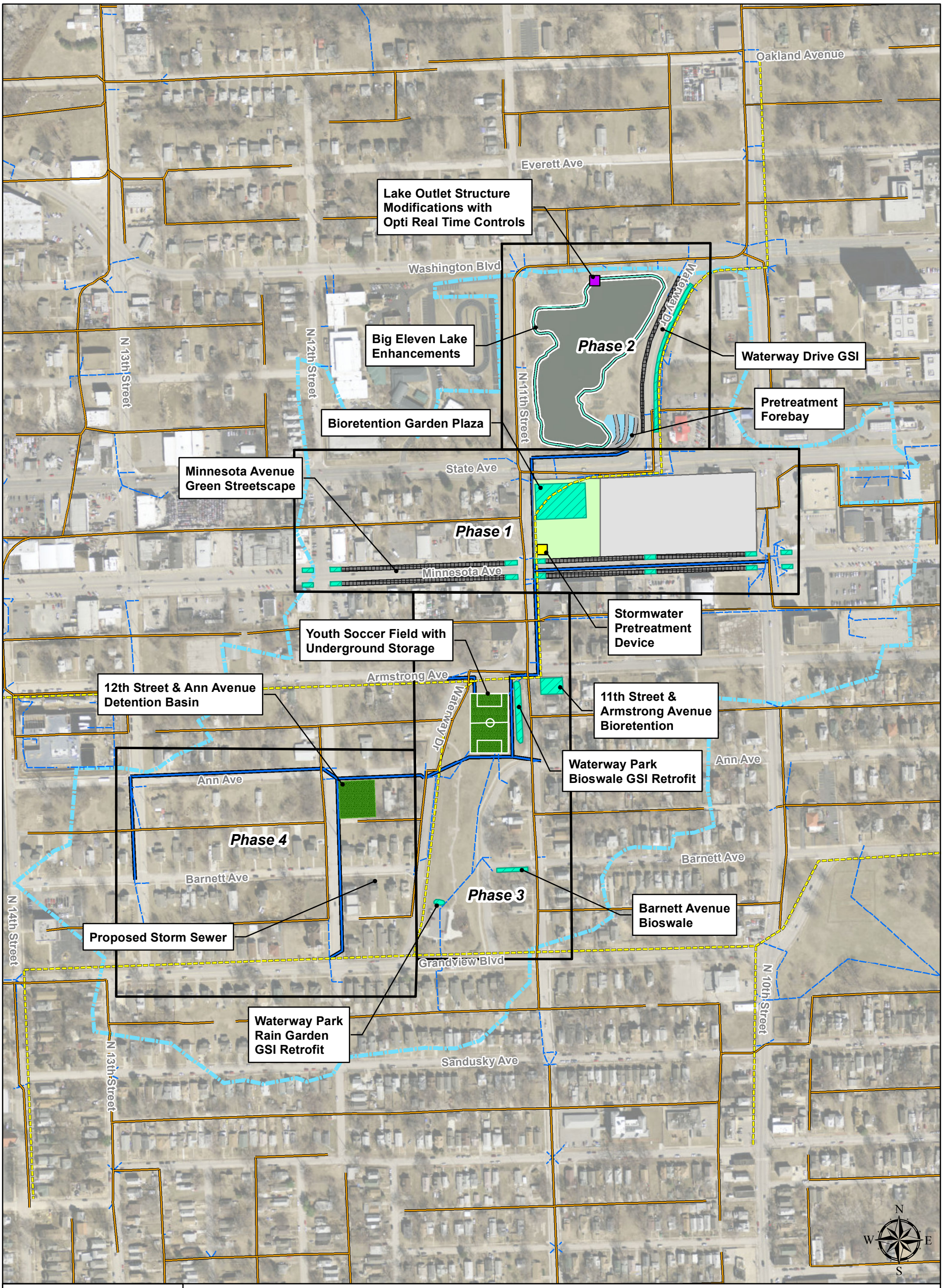


Figure 9-1: Unified Green Next Steps

The Unified Green project will reduce CSO volume and frequency at CSO 19, provide some flood control benefit, and improve the water quality of Big Eleven Lake. This project is proposed to be integrated into a planned urban redevelopment program that will be highly visible in the downtown district and is anticipated to stimulate urban renewal. Consisting of bioretention, bioswales, wetland forebays, and wetlands, implementing green stormwater infrastructure in this basin will provide a great opportunity to showcase different types of GSI and evaluate its performance. It will also be used to estimate the cost of construction, operation, and maintenance for future GSI efforts for future overflow control evaluations. Utilizing green in lieu of gray infrastructure can achieve this level of control while providing additional benefits for the community, as discussed in Section 7.0. The GSI proposed in the Unified Green project is flexible in type and layout, and can be modified to be cohesive with future urban redevelopment plans while providing equally significant overflow control at CSO 19. Unified Green is an excellent opportunity to educate and engage the public regarding sewer overflow control issues and provide the community an aesthetic infrastructure investment they can see, interact with and appreciate.

APPENDIX A – UNIFIED GREEN CONCEPT DESIGN OVERVIEW FIGURE



UNIFIED GREEN

Big Eleven Lake & Waterway Park Conceptual GSI Improvements

UNIFIED GOVERNMENT • Wyandotte County • Kansas City, Kansas •

LEGEND

- United Green Project Phases
- Proposed Drainage Area
- Healthy Campus Footprint
- Healthy Campus Open Space
- Heritage Trail Extension

GSI Improvements

- Pretreatment Forebay
- Bioretention
- Detention
- Permeable Pavers

Strategic Sewer Separation

- Proposed Storm Sewer
- Existing Storm Sewer
- Existing Combined Sewer

Feet

0 160 320 480 640

APPENDIX B – UTILITY INFORMATION

B.1 BPU Waterlines

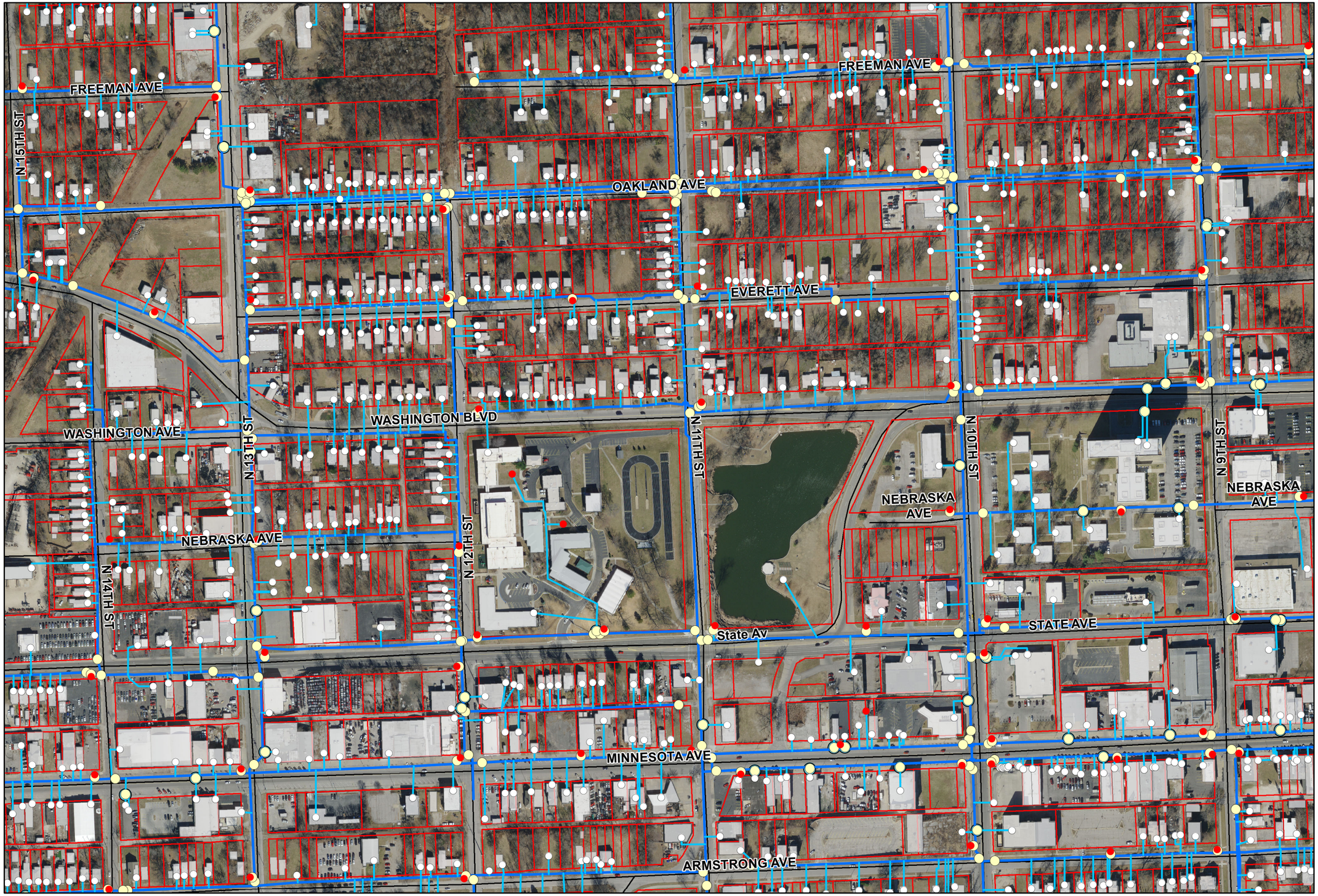
B.2 BPU Electric

B.3 BPU Traffic Signals

B.4 Kansas Gas Services

B.5 AT&T

B.1 BPU Waterlines



KANSAS CITY BPU
THE POWER OF COMMUNITY

0 180 360 720 1,080 1,440 Feet

N W E S

Legend

- Water Hydrants
- Water Service Connections
- Water System Valves
- Water Lateral Lines
- Main
- Building Footprint
- Parcel
- KDOT Roads
- Lot Line
- Parking Lot

2016 Photography

RGB

- Red: Band_1
- Green: Band_2
- Blue: Band_3

NOTES:

This map is a user generated static output and is for reference only. Data layers that appear on this map may or may not be accurated, current or otherwise reliable.
THIS MAP IS NOT TO BE USED FOR NAVIGATION

KANSAS CITY BPU
THE POWER OF COMMUNITY

0 180 360 720 1,080 1,440
Feet

N
W E
S

Legend

- Water Hydrants
- Water Service Connections
- Water System Valves
- Water Lateral Lines
- Main
- Building Footprint
- Parcel
- KDOT Roads
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2016 Photography

RGB

- Red: Band_1
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NOTES:

This map is a user generated static output and is for reference only. Data layers that appear on this map may or may not be accurated, current or otherwise reliable.
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B.2 BPU Electric

E-MAP BLOCKS

BPU WOOD POLE

BPU WOOD POLE W/FOREIGN ATTACHMENTS

FOREIGN POLE W/ BPU ATTACHMENTS

METAL POLE

FIBER POLE

CITY STOCK STREET LIGHT

RENTAL LIGHT

POWER FLOOD RENTAL

a 001001001 J — 1Ø POLE MOUNT TRANSFORMER (PHASING, MAP/GRID & KVA)

b a 001001001 — 2–1Ø POLE MOUNT TRANSFORMER BANK (PHASING, MAP/GRID & KVA)

J 001001001 L — 3–1Ø POLE MOUNT TRANSFORMER BANK (MAP/GRID & KVA)

M 001123456 — 1Ø PADMOUNT TRANSFORMER (MAP/GRID & KVA)

M 001123456 — 1Ø CONVENTIONAL TRANSFORMER IN JUNCTION BOX (MAP/GRID & KVA)

M 3 001123456 — 3Ø PADMOUNT TRANSFORMER (MAP/GRID & KVA)

M 001123456 — 3–1Ø CONVENTIONAL TRANSFORMERS ON ONE PAD OR IN TRANSCLOSURE (MAP/GRID & KVA)

JUNCTION BOX

U–POLE JUNCTION BOX

DIP

FUSE

1Ø OVERHEAD PRIMARY LINE

2Ø OVERHEAD PRIMARY LINE

3Ø OVERHEAD PRIMARY LINE

PADMOUNT SWITCH ENCLOSURE

SWITCH IN MANHOLE

PADMOUNT INTERRUPTER BOX

BELOW GRADE INTERRUPTER

CLOSED SWITCH

OPEN SWITCH

RATIO BANK

R.O. STATION

CAPACITOR BANK

TELE — TELEPHONE CABINET

CATV — CABLE TV CABINET

FL — FAULT LOCATOR

A — REVISION TAG

PULL BOX

123 — UNDERGROUND STREET LIGHT REFERENCE

123 — UNDERGROUND RESIDENTIAL DISTRIBUTION REFERENCE

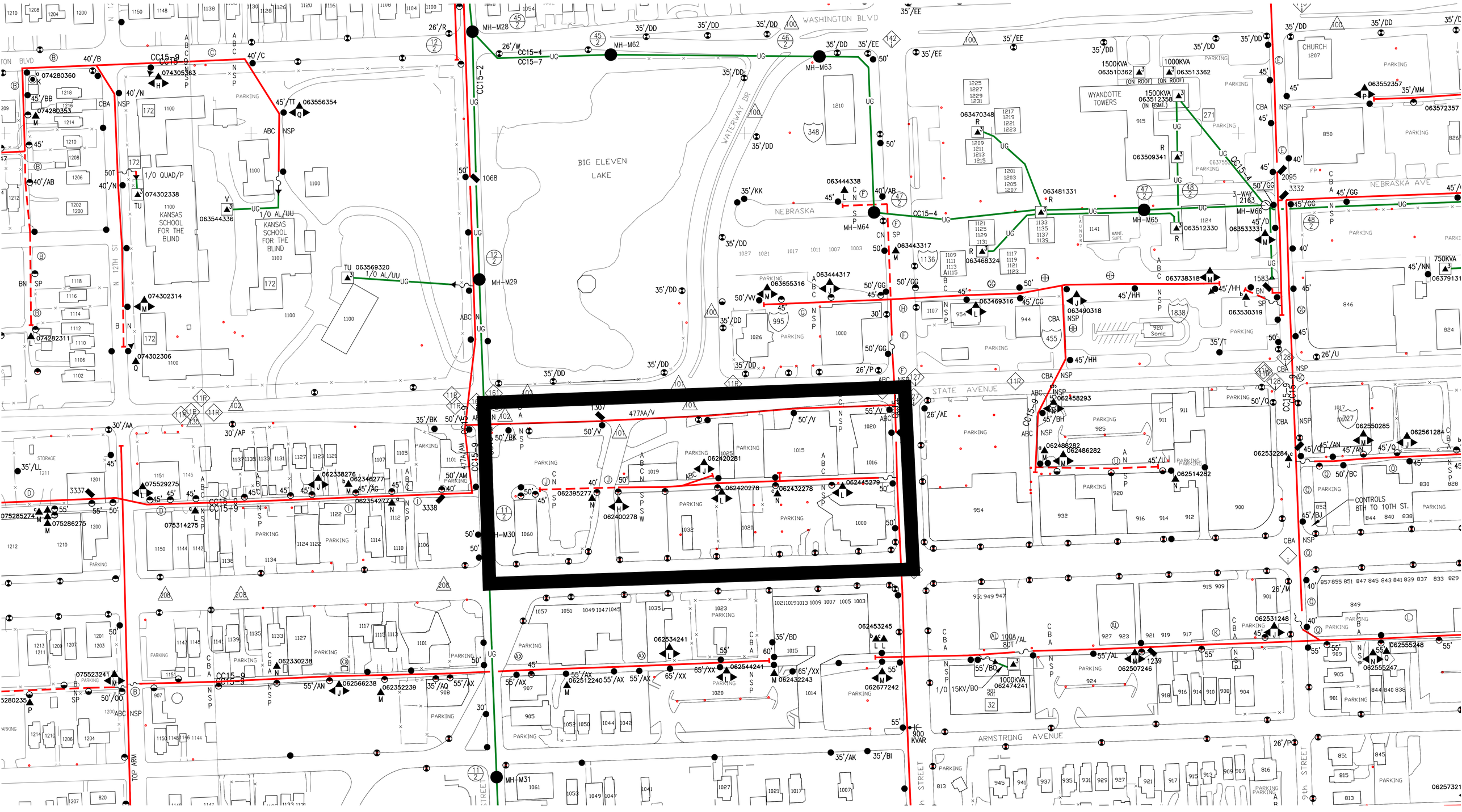
123 — TRAFFIC SIGNAL REFERENCE

1234 — UNDERGROUND SECONDARY SERVICE REFERENCE

UG — 1Ø UNDERGROUND PRIMARY LINE

UG — 2Ø UNDERGROUND PRIMARY LINE

UG — 3Ø UNDERGROUND PRIMARY LINE


WASHINGTON BLVD
BIG ELEVEN LAKE
WATERWAY DR
NEBRASKA
NEBRASKA AVE
STATE AVENUE
ARMSTRONG AVENUE
N 12TH ST
TOP ARM
9th STREET
WYANDOTTE TOWERS
CHURCH
KANSAS SCHOOL FOR THE BLIND
MH-M28
MH-M62
MH-M63
MH-M64
MH-M65
MH-M66
MH-M29
MH-M30
MH-M31
CC15-2
CC15-4
CC15-7
CC15-9
477AA/V
477AM
1/0 QUAD/P
1/0 AL/UU
1500KVA
1000KVA
750KVA
1000KVA
15KV/BO
100A/AL
CONTROLS 8TH TO 10TH ST.
PARKING
Sonic

Match Line
Sta 87+12
6" Sewer
Cond. Walk
14 way Tel. Duct
4 way Tel. Duct
2 Tel. Ducts
ALLEY
Tel. M.H.
CC15-2, MU15-12 (DEAD CABLE)
30" Water
2" Private water
42" Sewer
Sewer M.H.
WV
Sta 85+94.3
Brick Walk
MH M30
Sta 85+42.5
Hydrant
Sta 83+92.5
10" Sewer
6" Gas
8" Water
12" Water
MINNESOTA
AVE.
4" Gas (End Termination unknown)
15" Sewer
Sewer
Sta 84+45.0
Gas Valve
Sta 83+28.0
Sta 83+83.30
11TH ST.
Sta 81+48.0
Sta 81+40.4
Gaps due to inaccuracies in original chaining scaling or both
CONTROL CABLE
CC15-2
MU15-12 (DEAD CABLE)
LOOKING NORTH
M.H. M30
LOOKING SOUTH
M.H. M30
Straight grade thru gap
Tel. Ducts
Sewer
Water
Gas
430
420
450
440
410
Scale: Horiz. 1"=20'
Vert. 1"=10'

Match Line
ARMSTRONG
8" Gas
8 Tel. Ducts
Vit. Tel. Over Sewer 10' dp.
New Duct Under Existing Duc.: & Water Main 6' dp.
Sewer Break Out M.H.
MH M31
24" Water
30" Water
30" Sewer
9 M.T. Ducts T.E.L.
Sewer M.H. 13.1 dp.
Sewer 12.8 dp.
Sta 80+79.3
Sta 81+40.4
Sta 81+10.2
16" Water
6" Gas
ALLEY
Brick Walk
8" Hyd.
8" Water
ANN
4" Gas
Gas
WV
Sewer M.H. 13.6 dp.
Sta 77+95.7
WATERWAY DRIVE
Sewer M.H. 13.8 dp.
Sta 75+98.9
Sta 73+79.2
Sta 70+93.3
MU15-11
Brick Walk
8"-6" Sewers
Match Line
CONTROL CABLE
CC15-2
MU15-12 (DEAD CABLE)
LOOKING NORTH
M.H. M31
LOOKING SOUTH
M.H. 31
LOOKING NORTH
M.H. M32
LOOKING SOUTH
M.H. M32
LOOKING SOUTHEAST
M.H. M32
MU15-11
450
440
430
420
470
460
450

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REVISED 9-28-88
BY E.B.

UNDERGROUND ELECTRIC SYSTEM
KANSAS CITY, KANSAS
Conduit on 11th St. Sta. 74+93 to 87+72
BURNS & McDONNELL ENGINEERING CO.
KANSAS CITY CINCINNATI
1933
MAP 62
085012
11
AREA 2

PLAN
PROFILE
PLATE 2 PLAN-PROFILE U. P. R. STANDARD

SUBSTA. GROUNDS

ALLEY

EVERETT

ALLEY

WASHINGTON

Match Line

Sta 101+44.0

Sta 101+24.9

Sta 101+08.3

Sta 99+42.1

Sta 99+12.1

Sta 98+24.9

Sta 96+09.3

Sta 93+91.7

Sta 93+32.0

Sta 93+11.0

8" Pipe

Tel. Ducts 7

Tel. M.H.

Gas Pole

SMH 8' Deep

Hyd.

8" Water

CC15-4, CC15-2

CC15-7

MH M27

8 M.T. Light Dept. Ducts 7

8 M.T. Ducts

30" Water

SMH 10.5' Deep

SMH 7.5' Deep

Sta 98+24.9

10" Sewer at 4.00% Grade

14 Tel. Ducts 7

2 Tel. Ducts

4 Tel. Ducts 7

MH M28

11TH ST.

BRICK PAVING

ASPHALT PAVING

Sewer M.H.

51" Sewer

Gap due to inaccuracies in original chaining scaling or both

CONTROL CABLE

3-4/0 GROUNDS

CC15-2

CC15-4

CC15-7

LOOKING NORTH M.H. M28

MU15-12 CUT FREE & PLUGGED.

LOOKING SOUTH M.H. M28

LOOKING EAST M.H. M28

450

440

430

420

0

Scale: Horiz. 1"=20'
Vert. 1"=10'

LOOKING NORTH M.H. M27

LOOKING SOUTH M.H. M27

STATE

5.0' Conc. Walk

Sta 95+10.0

Sta 90+00

Sta 87+60

Sta 88+21.1

Sta 87+22

42" Sewer

MH M29

Catch Basin 3.9'dp.

Catch Basin 7.6'dp.

9.0'dp.

12.0'dp.

LOOKING NORTH M.H. M29

LOOKING SOUTH M.H. M29

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CALL 1-800-DIG-SAFE

Sect. B-B
12-4½" Fiber Ducts

NOTE:
12 WAY DUCT BEGINS AT STA. 89+15.83 AND CONTINUES NORTH TO POWER PLANT. 10 DUCTS GO SOUTH TO WYANDOTTE SUBSTATION.

NOTE:
SPLIT AROUND WATER VALVE BEGINS AT STA. 89+45.85 ENDS STA. 87+57.2

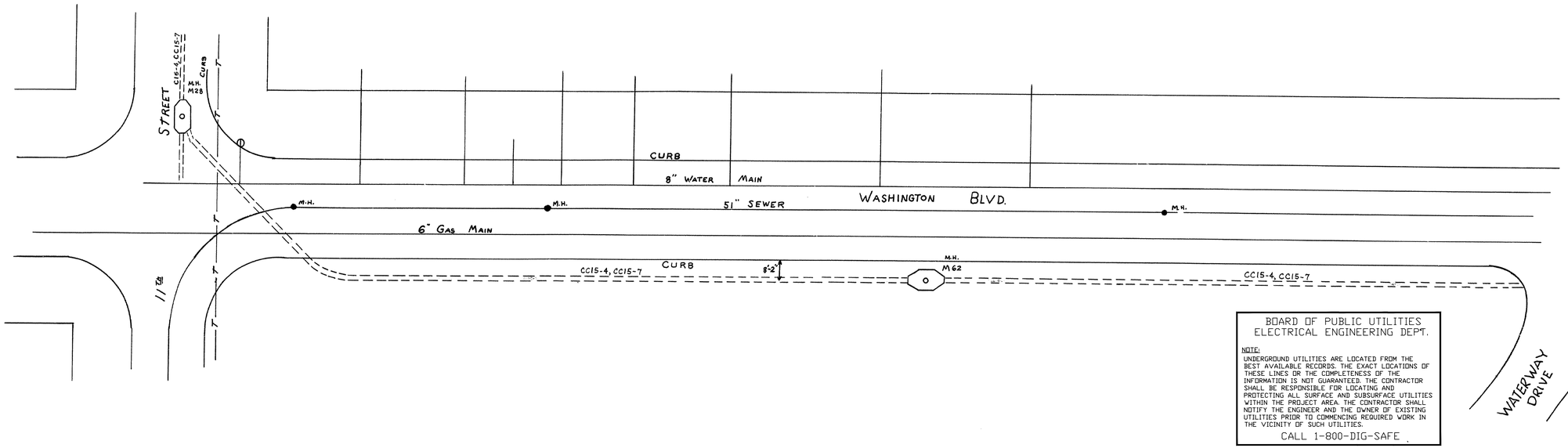
REVISED 7-28-88
BY E.B.

UNDERGROUND ELECTRIC SYSTEM
KANSAS CITY, KANSAS
Conduit on 11th St. Sta 87+72 to 101+44.0
BURNS & McDONNELL ENGINEERING CO.
KANSAS CITY CINCINNATI
1933
MAP 62,63

12
085012
AREA 2

PLATE 2 PLAN-PROFILE U. P. S. STANDARD

EUGENE DIETZGEN CO., CHICAGO, N. Y.



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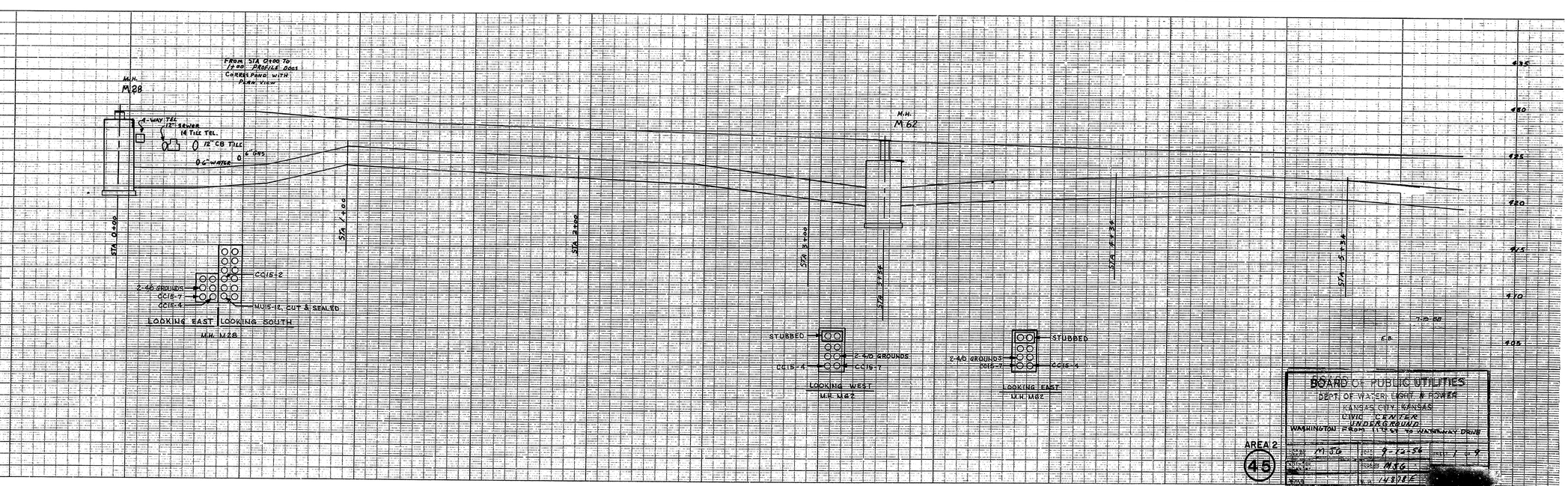


BOARD OF PUBLIC UTILITIES
DEPT. OF WATER, LIGHT & POWER
KANSAS CITY, KANSAS
CIVIC CENTER
UNDERGROUND
WASHINGTON FROM 11TH ST. TO WATERWAY DRIVE

DRAWN	M.J.G.	DATE	9-12-56
TRACED			
CHECKED	M.J.G.		
APPROVED			

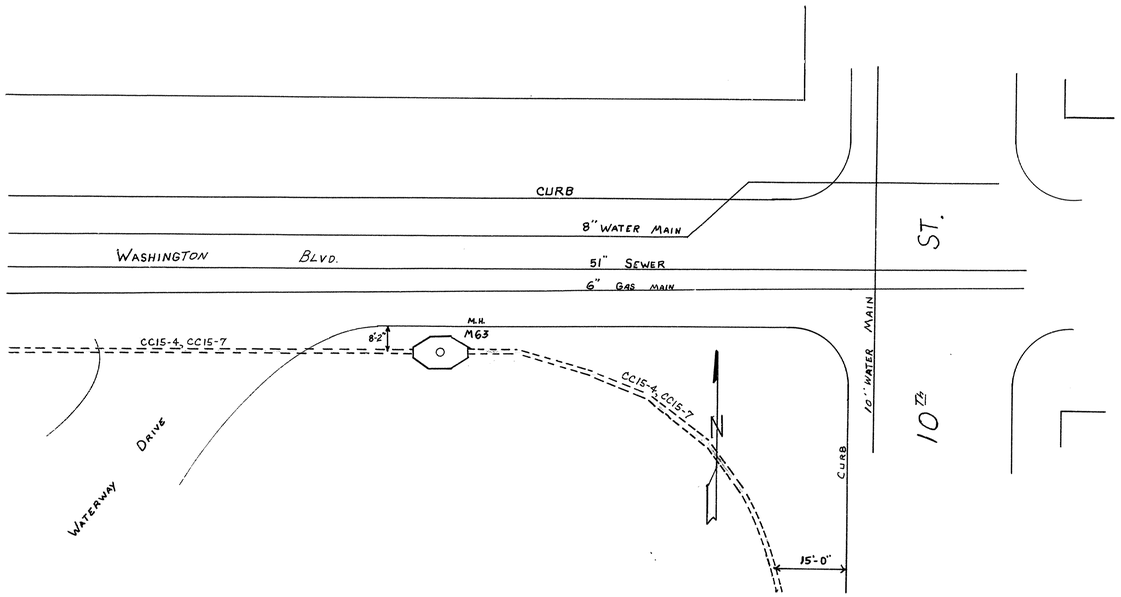
SHEET 1 OF 1

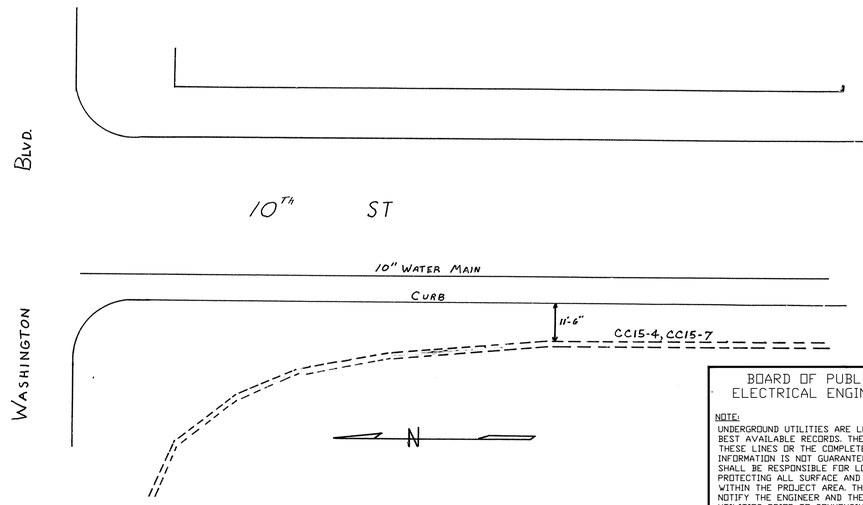
AREA 2
45

MAP 63

CHARLES BRUNING COMPANY
PLAN PROFILE PLATE A
PRINTED IN U.S.A.

CHARLES BRUNING COMPANY
PLAN PROFILE PLATE A
PRINTED IN U.S.A.





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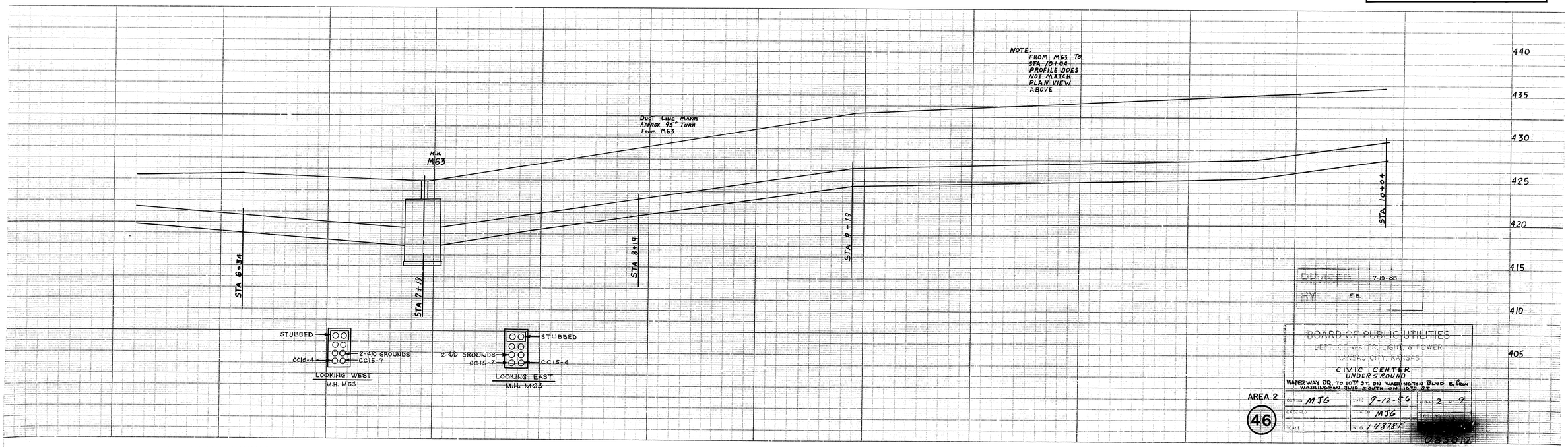
ELECTRICAL ENGINEERING DEPT.

NOTE:
UNDERGROUND UTILITIES ARE LOCATED FROM THE BEST AVAILABLE RECORDS. THE EXACT LOCATIONS OF THESE LINES OR THE COMPLETENESS OF THE INFORMATION IS NOT GUARANTEED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL SURFACE AND SUBSURFACE UTILITIES WITHIN THE PROJECT AREA. THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND THE OWNER OF EXISTING UTILITIES PRIOR TO COMMENCING REQUIRED WORK IN THE VICINITY OF SUCH UTILITIES.

CALL 1-800-DIG-SAFE



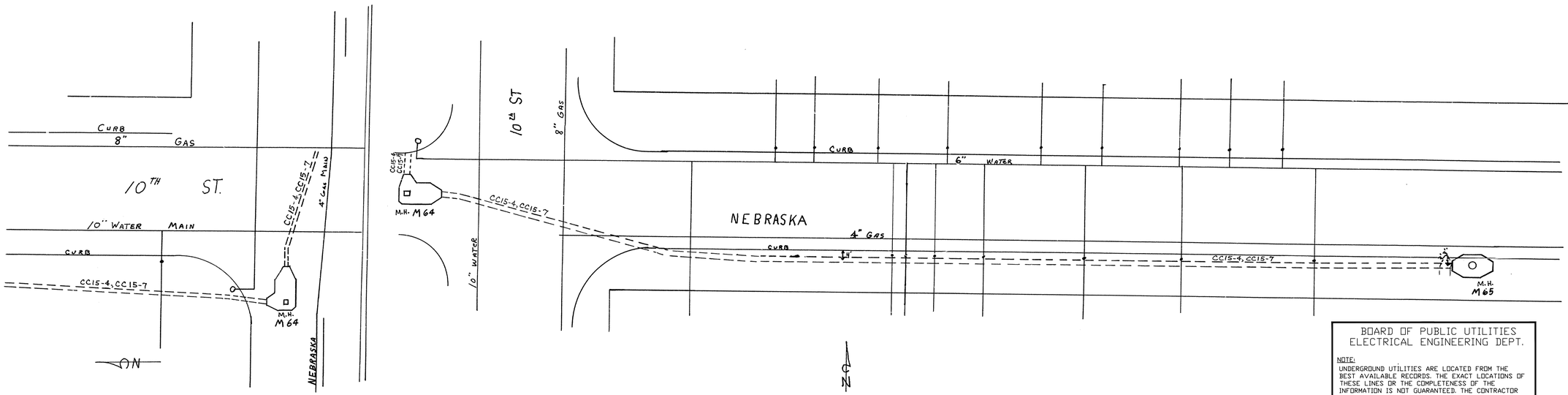
APPROVED 7-19-88
E.E.

BOARD OF PUBLIC UTILITIES
DEPT. OF WATER, LIGHT & POWER
KANSAS CITY, KANSAS
CIVIC CENTER
UNDERGROUND
WATERWAY DR. TO 10TH ST. ON WASHINGTON BLVD & FROM WASHINGTON BLVD SOUTH ON 11TH ST.

DRAWN	MJG	DATE	9-12-86
CHECKED		TRACED	MJG
SCALE		W.O.	148788

AREA 2
46
MAP 63

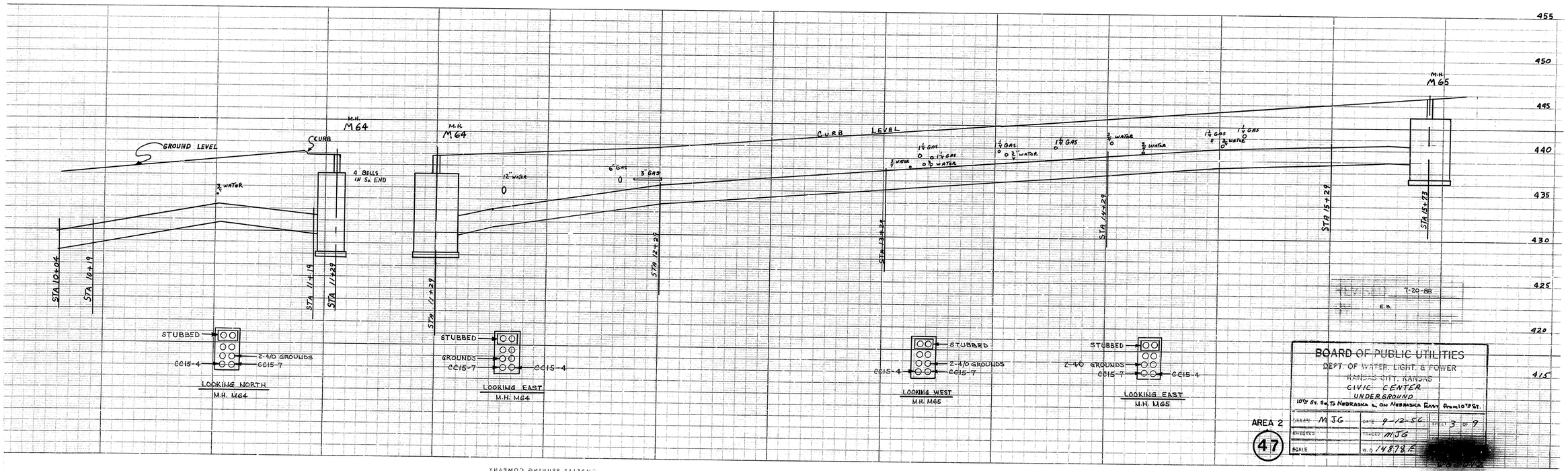
CHARLES BRUNING COMPANY
PLAN PROFILE PLATE A



BOARD OF PUBLIC UTILITIES
ELECTRICAL ENGINEERING DEPT.

NOTE:
UNDERGROUND UTILITIES ARE LOCATED FROM THE BEST AVAILABLE RECORDS. THE EXACT LOCATIONS OF THESE LINES OR THE COMPLETENESS OF THE INFORMATION IS NOT GUARANTEED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL SURFACE AND SUBSURFACE UTILITIES WITHIN THE PROJECT AREA. THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND THE OWNER OF EXISTING UTILITIES PRIOR TO COMMENCING REQUIRED WORK IN THE VICINITY OF SUCH UTILITIES.

CALL 1-800-DIG-SAFE



7-20-88
E.B.

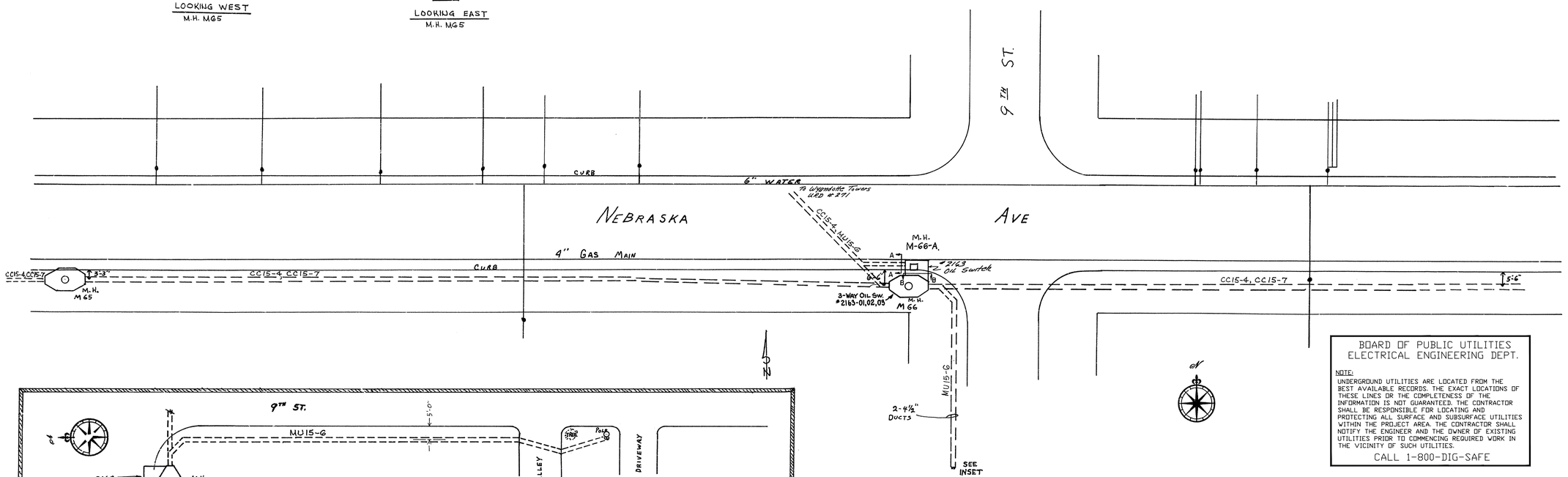
BOARD OF PUBLIC UTILITIES
DEPT OF WATER, LIGHT & POWER
KANSAS CITY, KANSAS
CIVIC CENTER
UNDERGROUND
10TH St. So. To NEBRASKA & ON NEBRASKA EAST From 10TH ST.

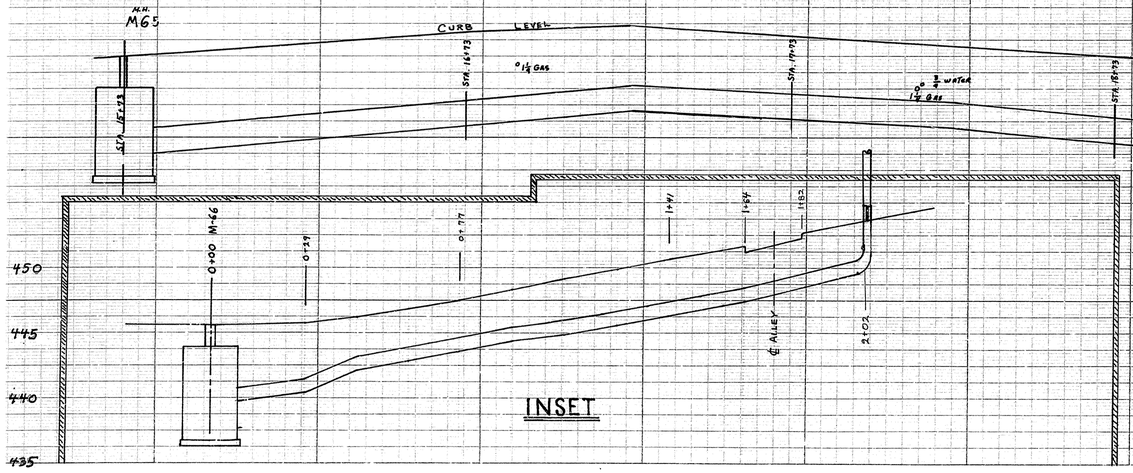
DRAWN MJG	DATE 9-12-56	SHEET 3 OF 9
CHECKED	TRACED MJG	
SCALE	W.O. 14878-E	

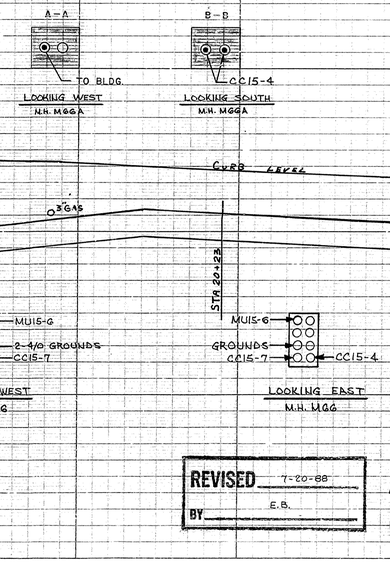
AREA 2
47

MAP 63

CHARLES BRUNING COMPANY
PLAN PROFILE PLATE A







BOARD OF PUBLIC UTILITIES
ELECTRICAL ENGINEERING DEPT.

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CALL 1-800-DIG-SAFE

465
460
455
450
445
440
435
430
425

REVISED 7-20-88
BY E.B.

BOARD OF PUBLIC UTILITIES
DEPT. OF WATER, LIGHT & POWER
KANSAS CITY, KANSAS
CIVIC CENTER UNDERGROUND
EAST ON NEBRASKA TO 127 FEET EAST OF 9TH ST.

DRAWN MJG	DATE 9-12-56	SHEET 4 of 9	
CHECKED	TRACED MJG		
SCALE	W.O. 14878E		

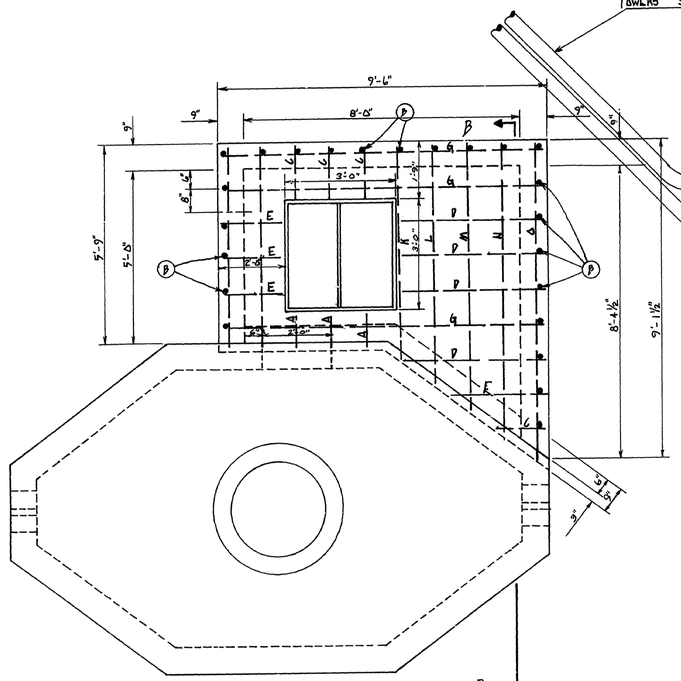
CONDUIT ADDED FROM M.H. M66 TO M.H. M66A

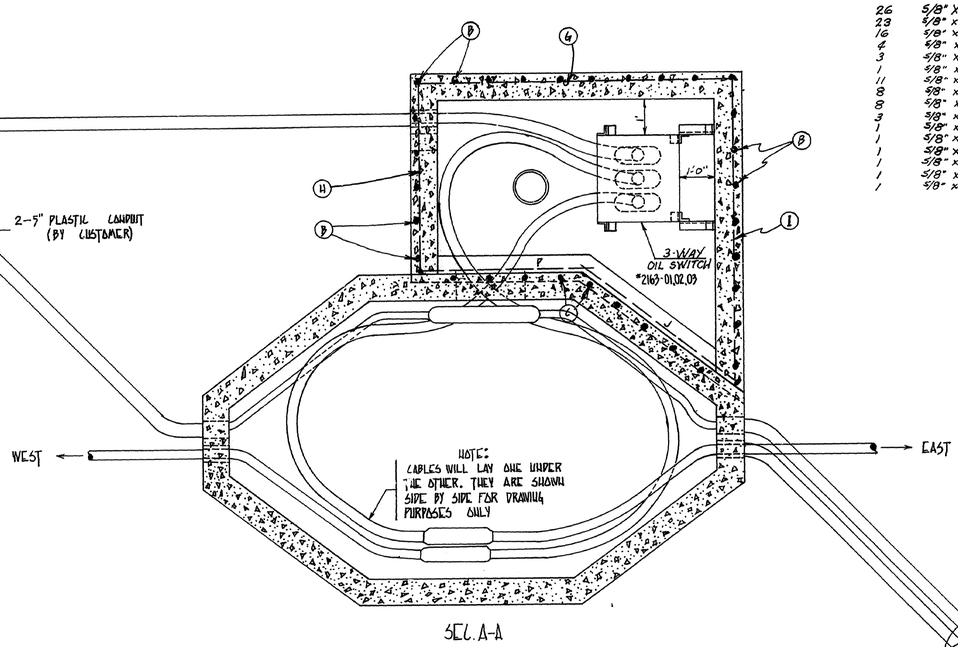
AREA 2
48

085012
MAP 63

CHARLES BRUNING COMPANY
PLAN PROFILE PLATE A

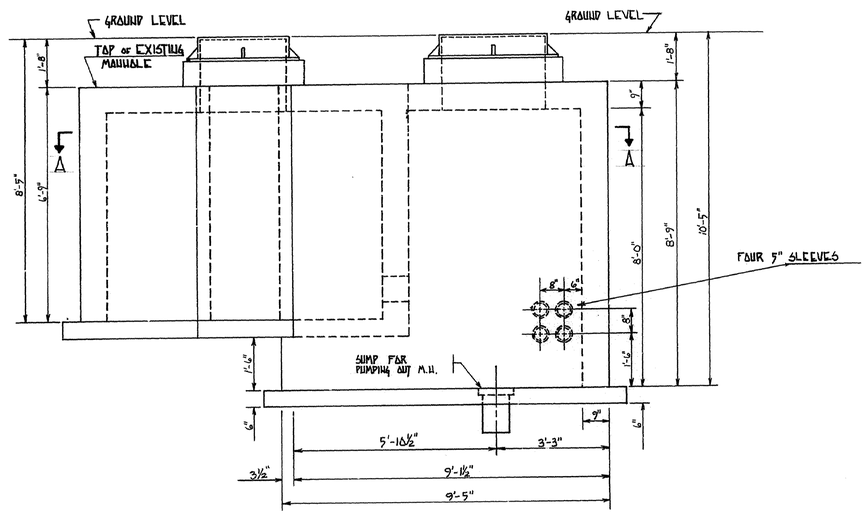
NOTE
CABLES RUN NORTHWEST TO WYANDOTTE TOWERS SUBST.

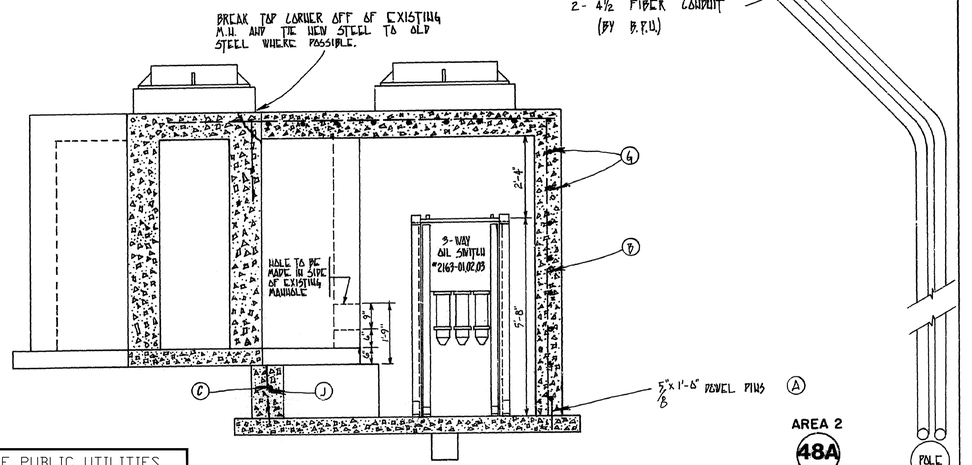




REINFORCING STEEL REQUIRED

26	5/8" X 1'-0"	A
23	5/8" x 8'-3"	B
16	5/8" x 1'-5"	C
4	5/8" x 4'-2"	D
3	5/8" x 1'-9"	E
1	5/8" x 2'-9"	F
11	5/8" x 9'-3"	G
8	5/8" x 5'-6"	H
8	5/8" x 8'-9"	I
3	5/8" x 6'-9"	J
1	5/8" x 6'-0"	K
1	5/8" x 7'-0"	L
1	5/8" x 7'-6"	M
1	5/8" x 1'-3"	N
1	5/8" x 9'-0"	O
1	5/8" x 3'-0"	P





BOARD OF PUBLIC UTILITIES
ELECTRICAL ENGINEERING DEPT.

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CALL 1-800-DIG-SAFE

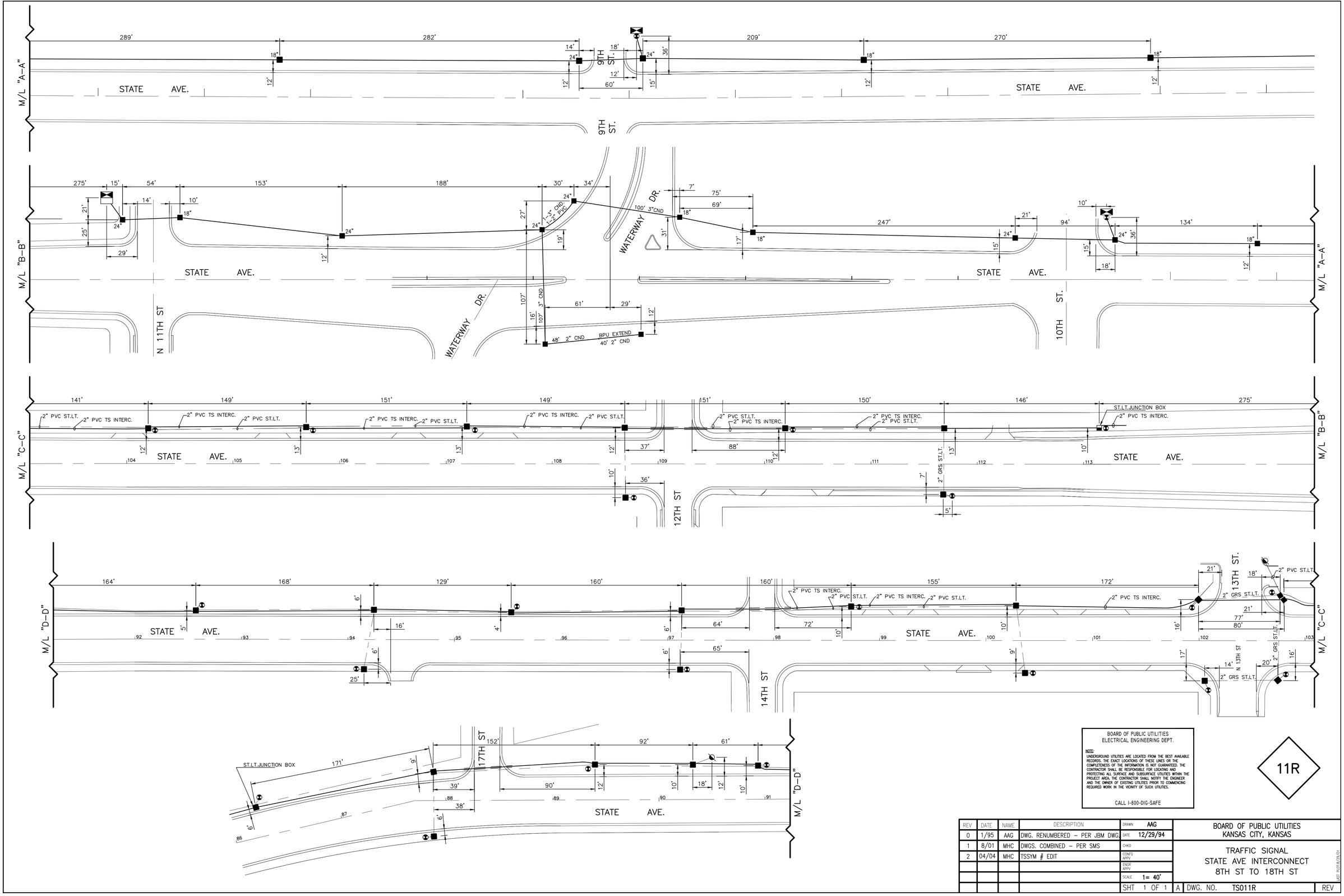
M.H. MGG
Q99

BOARD OF PUBLIC UTILITIES
DEPT. OF WATER, LIGHT, AND POWER
KANSAS CITY, KANSAS

Changes In Manhole At 9th And Nebraska
To Install 3-Way Oil Switch

DRAWN BY: H.W.P.	DATE: 1-3-67	SHEET 1 OF 1
CHECKED BY: H.W.P.	TRACED BY: J.A.Q.	DWG. 058012
SCALE: ½" = 1'-0"	W.O.	

B.3 BPU Traffic Signals



BOARD OF PUBLIC UTILITIES
ELECTRICAL ENGINEERING DEPT.

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CALL 1-800-DIG-SAFE

11R

REV	DATE	NAME	DESCRIPTION
0	1/95	AAG	DWG. RENUMBERED – PER JBM DWG.
1	8/01	MHC	DWGS. COMBINED – PER SMS
2	04/04	MHC	TSSYM # EDIT

DRAWN AAG
DATE 12/29/94
CHKD
CONFG APPV
ENGR APPV
SCALE 1= 40'
SHT 1 OF 1

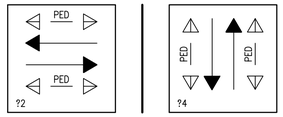
BOARD OF PUBLIC UTILITIES
KANSAS CITY, KANSAS

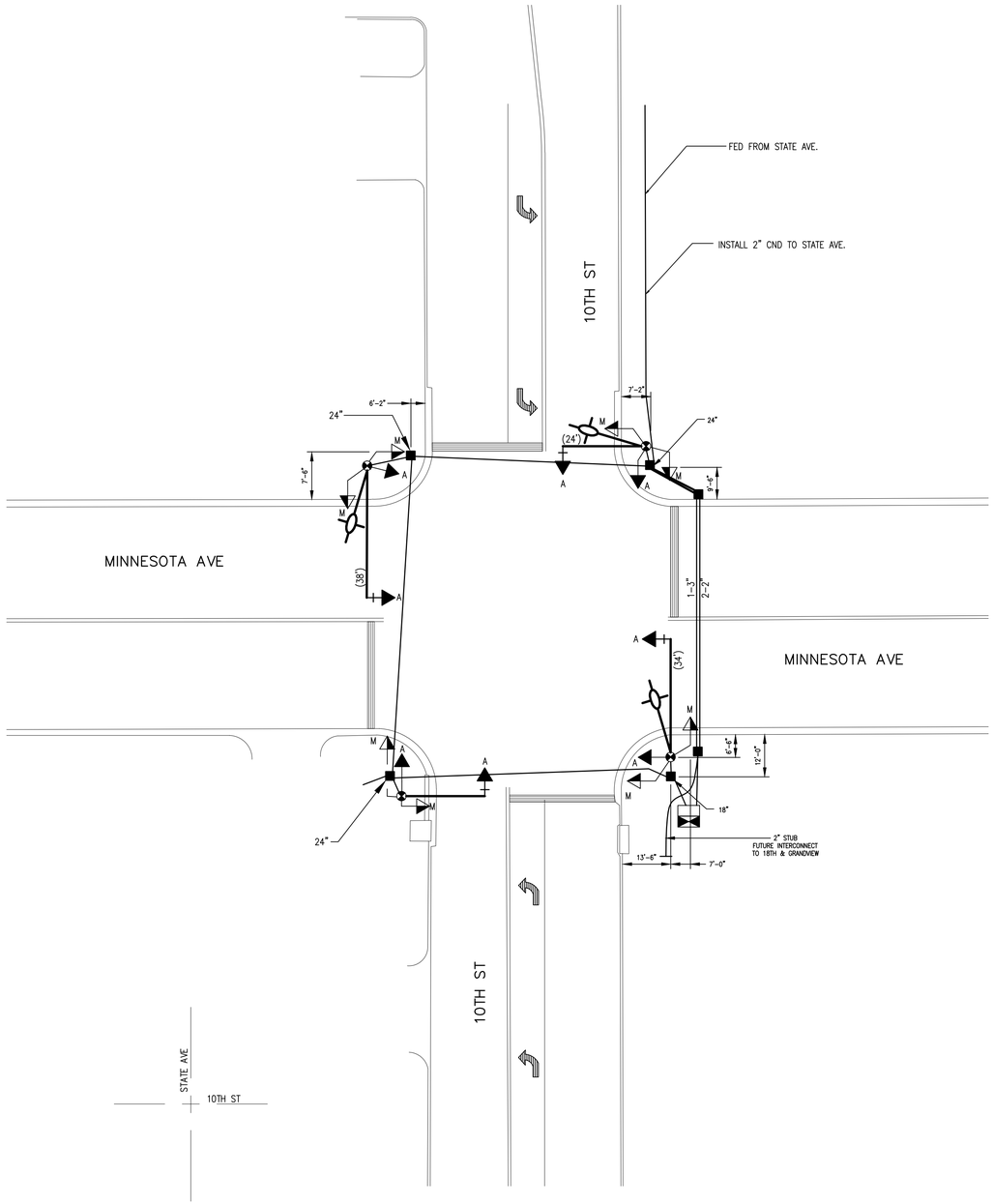
TRAFFIC SIGNAL
STATE AVE INTERCONNECT
8TH ST TO 18TH ST

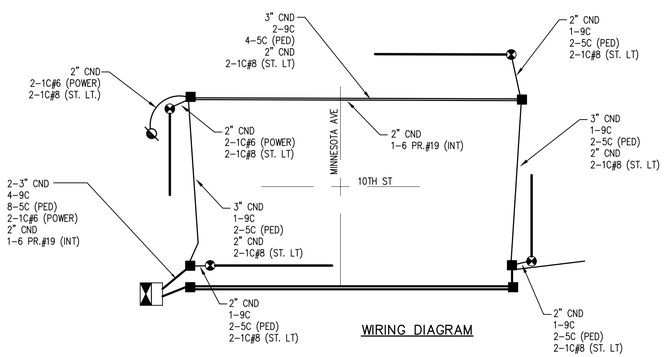
A | DWG. NO. TS011R | REV

LAST PLOTTED 7/29/01

SIGNAL PHASING

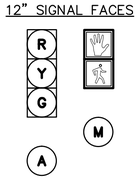






WIRING DIAGRAM

12" SIGNAL FACES



BOARD OF PUBLIC UTILITIES
ELECTRICAL ENGINEERING DEPT.

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CALL 1-800-DIG-SAFE

ASBUILT 58i

W.O.#20-7-06-014
MAP# 62,63

THIS DWG TRACED FROM JBM AND ASSOCIATES, INC. CONSULTING ENGINEERS
PROJECT #105 U-1413-01
DRAWN BY CHC

REV.	DATE	NAME	DESCRIPTION
1	11/94	MHC	REV. PER W.O. #20-2-06-032
2	5/25/95	SO	REV. PER ASBUILT
3	9/3/97	SO	PER W.O.#20-7-06-014
4	12/4/97	SO	PER ASBUILT
5	01/23/04	MHC	TSSYM # EDIT

DRAWN PGF
DATE 4/6/94
CHKD
CONFG APPV
ENGR APPV
SCALE 1" = 20'
SHT OF

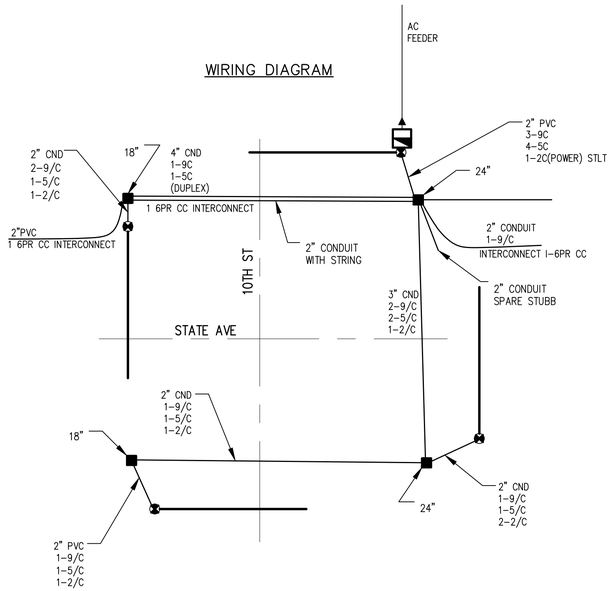
BOARD OF PUBLIC UTILITIES
KANSAS CITY, KANSAS

TRAFFIC SIGNAL
FOR
10TH ST. & MINNESOTA AVE.

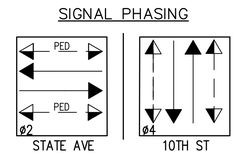
A DWG. NO. TS058i REV

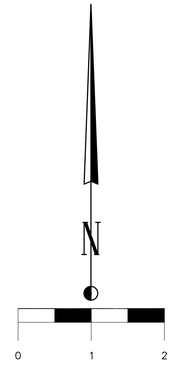
LAST PLOT: 01/23/04

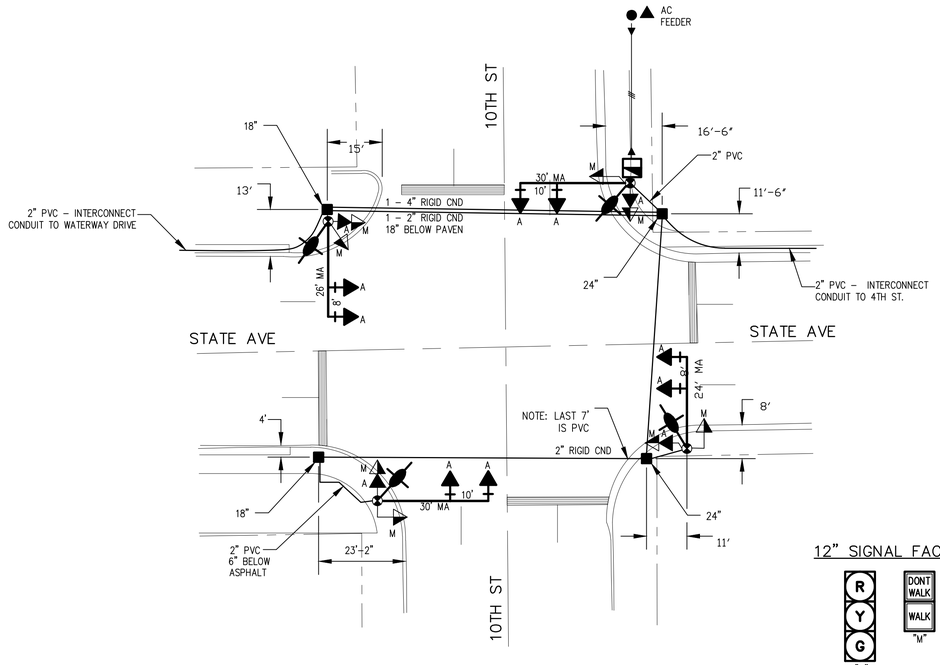
WIRING DIAGRAM



SIGNAL PHASING







12" SIGNAL FACES

BOARD OF PUBLIC UTILITIES
ELECTRICAL ENGINEERING DEPT.

NOTE:
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CALL 1-800-DIG-SAFE

ASBUILT

127i

REV.	DATE	NAME	DESCRIPTION
1	5/9/95	SO	ASBUILT PER FIELD NOTES
2	02/04	MHC	TSSYM # EDIT

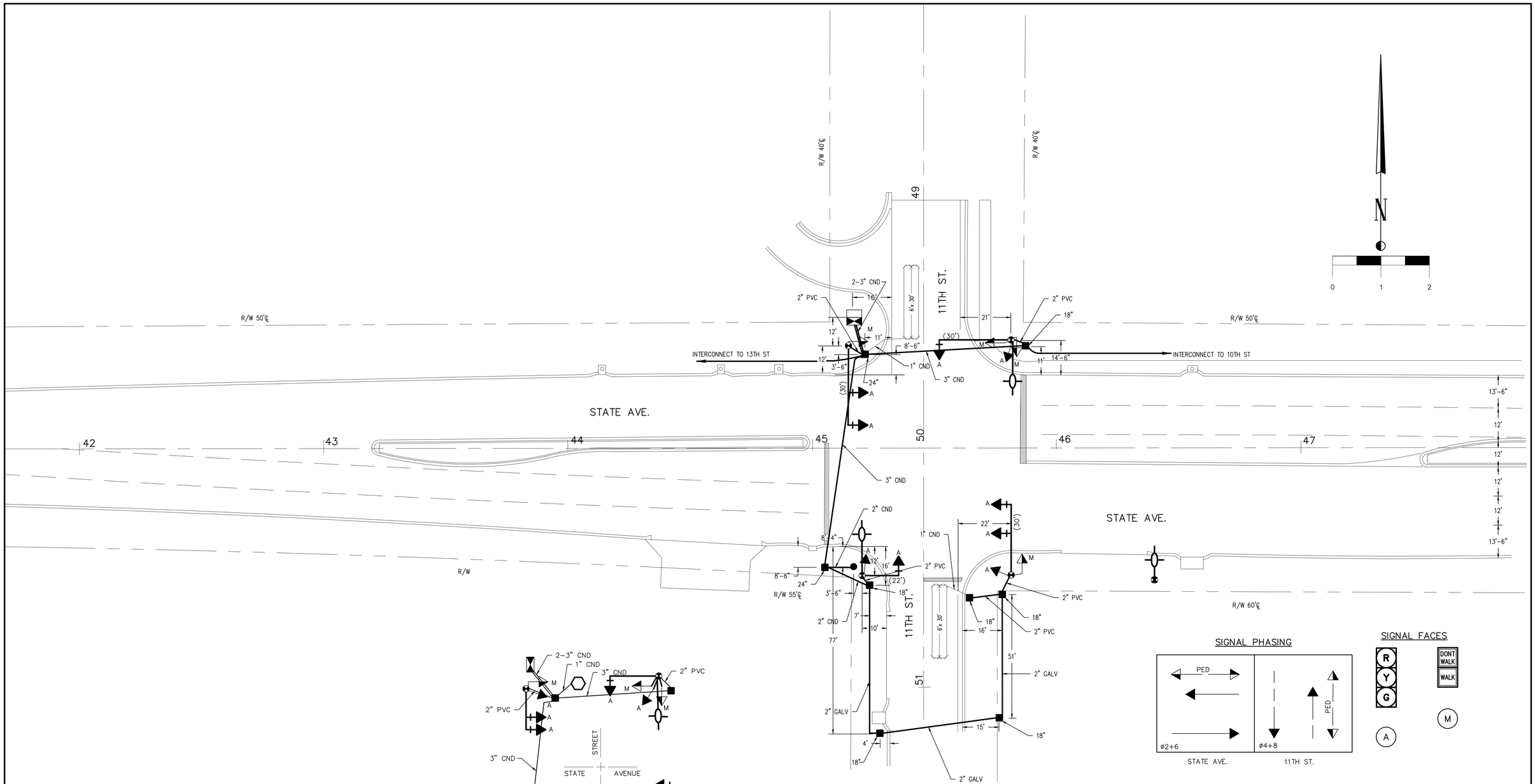
DRAWN PGF
DATE 10/14/92
CHKD
CONFG APPV
ENGR APPV
SCALE 1" = 20'
SHT OF

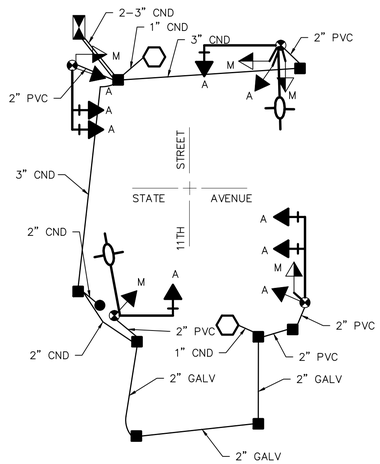
BOARD OF PUBLIC UTILITIES
KANSAS CITY, KANSAS

TRAFFIC SIGNAL
FOR
10TH ST. & STATE AVE.

A | DWG. NO. TS127i | REV

LAST PLOT: 02/02/04





ONE LINE DIAGRAM

SIGNAL PHASING

SIGNAL FACES

NON-ACTUATED MOVEMENT

ACTUATED MOVEMENT

BOARD OF PUBLIC UTILITIES
ELECTRICAL ENGINEERING DEPT.

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CALL 1-800-DIG-SAFE

161i

ASBUILT

W.O. # 20-8-06-019

REV.	DATE	NAME	DESCRIPTION
0	1/93	PGF	ASBUILT PRINT
1	02/04	MHC	TSSYM # EDIT

DRAWN PGF
DATE 7/17/89
CHKD
CONFG APPV
ENGR APPV
SCALE 1" = 20'
SHT OF

BOARD OF PUBLIC UTILITIES
KANSAS CITY, KANSAS

TRAFFIC SIGNALS
FOR
11TH ST. & STATE AVE.

A | DWG. NO. TS161i | REV

LAST PLOT: 02/04/04

B.4 Kansas Gas Services

ONE Gas Map

Legend

- CP Bond Junction
- CP Cable
  - Bond Wire
  - Rectifier Cable
- CP Ground Bed
- CP Rectifier
- CP Anode
- CP Test Station
- Controllable Fitting
  - Short Stop
  - 3-Way Tee
  - Tapping Tee
- Meter Setting
- Gas Valve
  - Critical/Inspection Not Required
  - Critical/Inspection Required
  - Non-Critical
- Regulator Station
- Town Border Station
- Drip
- Non Controllable Fitting
  - Other Non Controllable Fittings
  - Insulated Coupling
- Service Point
- Gas Main by SOP
  - 0.000000 - 1.000000
  - 1.000001 - 2.000000
  - 2.000001 - 10.000000
  - 10.000001 - 20.000000
  - 20.000001 - 40.000000
  - 40.000001 - 60.000000
  - 60.000001 - 100.000000
  - 100.000001 - 999.000000
  - Invalid SOP Value
- Gas Pipe Casing
- Service Line
  - <all other values>
  - Operating
  - Pending
  - Decommissioned
- Abandoned Gas Main
- Service Line (New Assets)
- Service Line - Pending Decom
  - Potentially Active, Pending Decomm
  - Offset - Potentially Active, Pending
- Streets Labels Only (KS)
- Streets Labels Only(OK)
- Streets Labels Only (TX)
- Parcel Boundary
- City Limit Boundaries
  - City Limits
  - Unincorporated
- County Boundaries
- PCAD City
- City of Austin Addresses
- Intersection
- World Street Map

1: 4,514

752.3 0 376.17 752.3 Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere

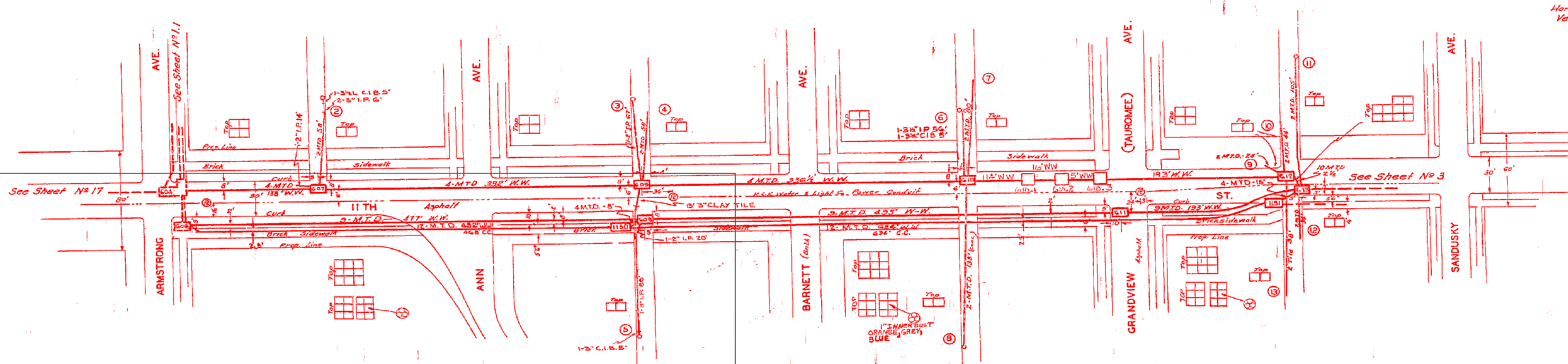
DISCLAIMER: This document and information herein is a visual representation and approximation of ONE Gas facilities and is subject to revision at any time without notice. It is an informational tool and is not guaranteed, warranted, or represented to be to scale, complete, accurate, or depicting depth. ONE Gas disclaims any and all liability for same. Call 811 by dialing 811 prior to and excavation.

Notes

B.5 AT&T

U.G. CONDUIT DR-FA ②

SCALE
Horizontal 1" = 60'
Vertical 1" = 40'



IN EFFECT
2-6-45
CORRECTED
Est. 1448 WH 10-29-43
RO 92348 '59
EST. 6237 '60-'61
RECONCIL. 12-31-63
EST. F6960 '65-68
CORR. 12-31-68
RECONCIL. 12-31-68
EST. 5439 '71-72
RECONCIL. 12-31-73
RECONCIL. 12-31-76
EST 6657 '79 '83
EST 0600300 '86
(92) D422474 '92

MANHOLES

M. H.	INSIDE DIMENS. L. W. HD. RM.	MIN. OPEN INC.	SHAPE	RECESS AT DUCTS	TOTAL DEPTH OF EXCAV'TN	WALLS	ROOF	FLOOR	OUTER COVER SHAPE	OUTER COVER WT.	WT. INSIDE COVER	WT. FRAME	DRAIN	DATE	REMARKS
607	7'x 4'x 4'	23"	(oval)			Brick	Rail	Dirt	Round						
609	7'x 4'x 4'	23"	(oval)			"	"	"	"						
610	7½'x 4'x 3'	23"	(oval)			"	"	"	"						
612	7'x 3½'x 3½'	23"	(oval)			"	"	"	"						
608	8'x 3½'x 5½'	27"	Type A Rect.	6"	91"	Conc 6"	Conc. 6"	Conc 3"	Round	230	None	Type B 380	Sump.	1938	Est. 1448
611	8'x 3½'x 5½'	27"	Type A Rect.	6"	100"	Conc. 6"	Conc. 6"	Conc. 3"	Round	230	None	Type B 380	Sump.	1938	Est. 1448
613	8'x 4'x 5'	29"	(rect.)	—	—	Brick	Rail	Dirt	Round	—	—	—	—	—	
1130	12'x 6'x 6'6"	27"	TYPE A										SUMP.	1971	EST. 5439
1131	12'x 6'x 6'6"	...	TYPE A										SUMP.	1971	EST. 5439
610.1	4'x 8'x 6'	30"	TYPE B			CONC	CONC	CONC					SUMP	1992	
610.2	4'x 8'x 6'	30"	TYPE B			CONC	CONC	CONC					SUMP	1992	
610.3	4'x 8'x 6'	30"	TYPE B			CONC	CONC	CONC					SUMP	1992	

MAIN CONDUIT

ACCT. CLASSIFICATION. EXCHANGE.

FROM M. H.	TO & INCL. M. H.	ORIGINAL PAVE SURFACE	ORIGINAL PAVE BASE	ORIGINAL PAVE LENGTH	SUB. SURFACE TYPE	SUB. SURFACE LENGTH	DATE	REMARKS
903	607	Asphalt	Conc.	151'	Clay	143'		
607	609	"	"	339'	"	332'		
609	610	"	"	344'	"	336'		
610	612	"	"	359'	"	352'		
612	613	"	"	5'	"	2½		
904	608	Asphalt " Sod	Conc " Earth	13' 401'	Clay	479'	'38	Street Alley Parking Est. 1448
608	611	Asphalt Brick Conc Sod	Conc " " Earth	13' 30' 18' 440'	Clay	495'	38	Alley & Street Street Alley Parking Est. 1448
611	613	Asphalt Sod.	Conc. Earth	84' 117	Clay	133'	'38	Street Parking Est. 1448
606	1130					458'	'71	EST. 5439
1130	1131					682'	'71	EST. 5439
1130	608					8'	'71	EST. 5439'
1131	613					15'	'71	EST. 5439'

LATERALS

NO.	ORIGINAL PAVE SURFACE	ORIGINAL PAVE BASE	ORIGINAL PAVE LENGTH	SUB. SURFACE TYPE	SUB. SURFACE LENGTH	DATE	REMARKS
~~1~~	~~Asph. Dirt~~	~~Conc~~	~~33' 72'~~	~~Clay~~	~~103'~~		RM. 61 EST. 6237
2	Asph. Dirt	Conc	33' 27'	"	64' ~~58'~~		
3	Asph. Dirt	Conc	33' 36'	"	67'		
4	Asph Dirt	Conc.	33' 27'	"	58'		
~~5~~	~~Asph. Dirt~~	~~Conc~~	~~42' 77'~~	"	~~122'~~		RM. EST. 6237
~~6~~	~~Asph. Dirt~~	~~Conc~~	~~22 36~~	—	~~56'~~		RM RO 92348 '59
7	Asph. Dirt	Conc.	33' 49	"	80'		
8	Asph Conc		22 113	"	133'		
9	Asph.	Conc.	24'	"	24'		
10	Asph Dirt.	Conc.	33' 13'	"	44'		
11	Asph. Dirt	Conc.	38' 70'	"	105'		

TAX DIST. V-4-300

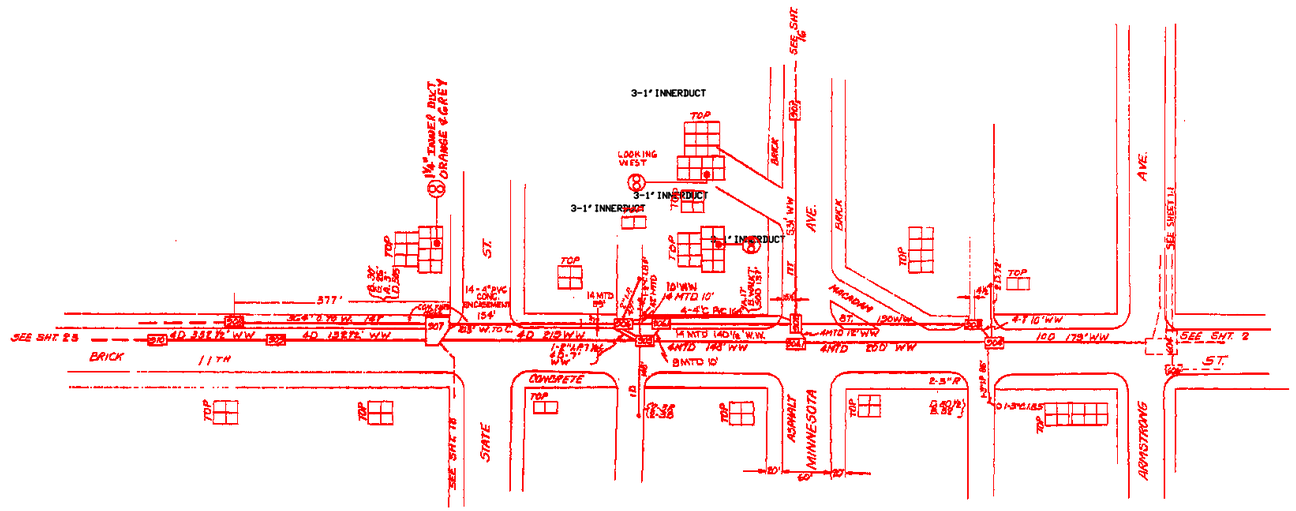
NO.	ORIGINAL PAVE SURFACE	ORIGINAL PAVE BASE	ORIGINAL PAVE LENGTH	SUB. SURFACE TYPE	SUB. SURFACE LENGTH	DATE	REMARKS
12	Asph Dirt.	Conc	20' 16'	Clay	34'		
13	Asph. Dirt	Conc.	47' 53'	"	98'		
6			5' 56'		61'		
5					106'	'61	EST. 6237

Drawn By W.W. Hunt 10-29-43

②

Southwestern Bell Telephone Company - OPTI-RECORDS

Map: C-8
Market Area: KANSAS CITY
NPA/NNX: 913881
Exchange: DREXEL
Map Type: CAB
Geo. Loc: KK9065
Tax District:
N:
S:
E:
W:
NNE:
NNW:
SSE:
SSW:
Scale: NONE
Update: 12/11/2008



M.H.	INSIDE DIMENS. L	W.	HGHT.	OTHER OWNERSHIP	TYPE	OPENING	MATERIAL WALLS	ROOF	FLOOR	DEPTH EXCAV.	DATE	REMARKS
902	2½'	x 2'	x 6'				BRICK	RAIL	DIRT			
905	6½'	x 4'	x 5'				BRICK	RAIL	DIRT			
808	5'	x 4'	x 5½'				BRICK	RAIL	DIRT			
903	6'	x 4'	x 5½'				BRICK	RAIL	DIRT			
904	12'	x 6'8"	x 6'6"				CONC.	CONC.	CONC.			REBUILT - EST. 3488
906	7'	x 4'	x 4'				BRICK	RAIL	DIRT			
909	7'	x 3½'	x 3½'				BRICK	RAIL	DIRT			
910	7'	x 3½'	x 4'				BRICK	RAIL	DIRT			
907	12½'	x 9'	x 5½'				CONC.	CONC.	CONC.		'28	EST. N° 128
906A	9'	x 6'	x 6'				CONC.	CONC.	CONC.		'66	EST. P-6980
908A	8½'	x 14½'	x 6'		'A'	27"	CONC.	CONC.	CONC.		'68	EST. P-7456
908	85'	x 65'	x 7'0"								'75-'79	REBUILT - ROYSTOT
902	12'	x 6'	x 7'		"B"	30"					'21	EST. 6741 REBUILT

N

SCALE (APPROX.)

SOUTHWESTERN BELL TELEPHONE COMPANY

DIVISION NORTHERN

EXCHANGE DREXEL

DISTRICT KANSAS CITY

TAX DISTRICT WY-300 PLAT NO. 1

Southwestern Bell Telephone Company – OPTI-RECORDS

Map C-17 Map Type LDN
Market Area KANSAS CITY
NPA/NXX 913/305 Exchange DREXEL Geo. Loc. 1017965
Tax District WY300
N C-23G
S C-23
E C-24
W C-18
MID
NW
SW
SE

Scale NONE
Update 12/11/2000

APPENDIX C – OPINION OF PROBABLE COST

UNIFIED GREEN PHASE 1 CONCEPTUAL DESIGN OPINION OF PROBABLE COST: WQv LOS				
ITEM	**QUANTITY**	**UNIT**	**UNIT COST**	**COST**
DEMOLITION/RESTORATION				
BUILDING DEMOLITION	1	LS	$78,600	$78,600
REMOVE EXISTING INLET	29	EA	$800	$23,200
REMOVE/REPLACE EXISTING STREET PAVEMENT	5560	SY	$68	$376,690
REMOVE/REPLACE STANDARD CURB & GUTTER	5490	LF	$30	$164,700
REMOVE/REPLACE COMMERCIAL DRIVEWAY	933	SY	$86	$80,267
REMOVE/REPLACE RESIDENTIAL DRIVEWAY	83	SY	$60	$5,000
REMOVE/REPLACE WALKWAY - STAIRS	15	EA	$1,800	$27,000
REMOVE & REPLACE SIDEWALK	29960	SF	$11	$329,560
CONSTRUCT NEW ADA RAMP	38	EA	$350	$13,300
STORM SEWER CONSTRUCTION				
STORMWATER PIPE - 15" RCP	200	LF	$97	$19,300
STORMWATER PIPE - 24" RCP	840	LF	$119	$99,540.00
STORMWATER PIPE - 42" RCP	460	LF	$209	$96,140.00
STORMWATER PIPE - 48" RCP	350	LF	$207	$72,450
CURB INLET	20	EA	$5,000	$100,000
STORMWATER MANHOLE	7	EA	$5,000	$35,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION				
ENGINEERED SOIL MIX	2861	CY	$30	$85,837
PERMEABLE PAVERS	39804	SF	$12	$477,647
STORAGE AGGREGATE (NO. 57)	8511	TON	$30	$255,323
CHOKER COURSE (NO. 8)	572	CY	$20	$11,445
GEOMEMBRANE	1783	SY	$25	$44,583
UNDERDRAIN - 6" PERFORATED PVC	3560	LF	$19	$67,640
PVC CLEANOUT	17	EA	$70	$1,190
GREEN OUTLET CONTROL	15	EA	$1,000	$15,000
STORMWATER PRETREATMENT DEVICE	1	EA	$190,000	$190,000
RIBBON CURB	2550	LF	$15	$38,250
LANDSCAPING				
BIORETENTION LANDSCAPING	30901	SF	$8	$247,211
			SUBTOTAL	**$2,955,000**
GENERAL CONSTRUCTION				
PROPERTY ACQUISITION	1	LS	$262,000	$262,000
E&S CONTROL	5%			$148,000
TRAFFIC CONTROL	2%			$59,000
ENGINEERING DESIGN	15%			$443,000
CONTIGENCY	25%			$967,000
			PHASE 1 TOTAL (Rounded to the nearest $100k)	**$4,900,000**

UNIFIED GREEN PHASE 2 CONCEPTUAL DESIGN OPINION OF PROBABLE COST: WQv LOS				
ITEM	**QUANTITY**	**UNIT**	**UNIT COST**	**COST**
DEMOLITION/RESTORATION				
REMOVE EXISTING INLET	13	EA	$800	$10,400
REMOVE/REPLACE EXISTING STREET PAVEMENT	1920	SY	$68	$130,080
REMOVE/REPLACE STANDARD CURB & GUTTER	1380	LF	$30	$41,400
REMOVE & REPLACE SIDEWALK	5760	SF	$11	$63,360
CONSTRUCT NEW ADA RAMP	4	EA	$350	$1,400
REMOVE EXISTING TREE	5	EA	$1,500	$7,500
STORM SEWER CONSTRUCTION				
STORMWATER PIPE - 15" RCP	60	LF	$97	$5,790
CURB INLET	6	EA	$5,000	$30,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION				
FILL (ON-SITE GRADING)	3142	CY	$2	$6,284
ENGINEERED SOIL MIX	628	CY	$30	$18,832
PERMEABLE PAVERS	6774	SF	$12	$81,287
STORAGE AGGREGATE (NO. 57)	677	TON	$30	$20,322
CHOKER COURSE (NO. 8)	126	CY	$20	$2,511
GEOMEMBRANE	647	SY	$25	$16,181
UNDERDRAIN - 6" PERFORATED PVC	1110	LF	$19	$21,090
PVC CLEANOUT	4	EA	$70	$280
GREEN OUTLET CONTROL	2	EA	$1,000	$2,000
LAKE OUTLET CONTROL STRUCTURE	1	EA	$50,000	$50,000
OPTI REAL-TIME CONTROL	1	EA	$51,626	$51,626
6" REINFORCED CONCRETE CAP (BIG 11 LAKE)	20	CY	$400	$7,815
MODULAR BLOCK WALL	3167	SFF	$55	$174,167
RIBBON CURB	600	LF	$15	$9,000
TIED CONCRETE BLOCK MAT	1208	SY	$80	$96,676
LANDSCAPING				
2" CALIPER TREES	15	EA	$500	$7,500
BIORETENTION LANDSCAPING	6780	SF	$8	$54,236
			SUBTOTAL	**$910,000**
GENERAL CONSTRUCTION				
E&S CONTROL	2%			$18,000
TRAFFIC CONTROL	5%			$46,000
ENGINEERING DESIGN	15%			$137,000
CONTIGENCY	25%			$278,000
PHASE 2 TOTAL (Rounded to the nearest $100k)				**$1,400,000**

UNIFIED GREEN PHASE 3 CONCEPTUAL DESIGN OPINION OF PROBABLE COST: WQv LOS				
ITEM	**QUANTITY**	**UNIT**	**UNIT COST**	**COST**
DEMOLITION/RESTORATION				
BUILDING DEMOLITION	1	LS	$50,700	$50,700
REMOVE EXISTING INLET	9	EA	$800	$7,200
REMOVE/REPLACE EXISTING STREET PAVEMENT	1120	SY	$68	$75,880
REMOVE/REPLACE STANDARD CURB & GUTTER	780	LF	$30	$23,400
REMOVE/REPLACE COMMERCIAL DRIVEWAY	89	SY	$86	$7,644
REMOVE/REPLACE ALLEYWAY DRIVE	22	SY	$86	$1,911
REMOVE & REPLACE SIDEWALK	2440	SF	$11	$26,840
CONSTRUCT NEW SIDEWALK	560	SF	$10	$5,600
CONSTRUCT NEW ADA RAMP	24	EA	$350	$8,400
STORM SEWER CONSTRUCTION				
STORMWATER PIPE - 15" RCP	380	LF	$97	$36,670
STORMWATER PIPE - 30" RCP	290	LF	$114	$33,060
STORMWATER PIPE - 36" RCP	770	LF	$210	$161,700
CURB INLET	11	EA	$5,000	$55,000
STORMWATER MANHOLE	11	EA	$5,000	$55,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION				
EXCAVATION (ON-SITE GRADING)	5285	CY	$4	$21,141
FILL (ON-SITE GRADING)	2061	CY	$2	$4,122
ENGINEERED SOIL MIX	1043	CY	$30	$31,291
STORAGE AGGREGATE (NO. 57)	1760	TON	$30	$52,804
CHOKER COURSE (NO. 8)	209	CY	$20	$4,172
STORMTECH UNDERGROUND STORAGE	67082	CF	$8	$536,659
UNDERDRAIN - 6" PERFORATED PVC	400	LF	$19	$7,600
PVC CLEANOUT	4	EA	$70	$280
GREEN OUTLET CONTROL	4	EA	$1,000	$4,000
LANDSCAPING				
BIORETENTION LANDSCAPING	11265	SF	$8	$90,118
SOD	3171	SY	$7	$22,198
			SUBTOTAL	**$1,323,000**
GENERAL CONSTRUCTION				
PROPERTY ACQUISITION	1	LS	$169,000	$169,000
E&S CONTROL	5%			$66,000
TRAFFIC CONTROL	2%			$26,000
ENGINEERING DESIGN	15%			$198,000
CONTIGENCY	25%			$446,000
PHASE 3 TOTAL (Rounded to the nearest $100k)				**$2,300,000**

UNIFIED GREEN PHASE 4 CONCEPTUAL DESIGN OPINION OF PROBABLE COST: WQv LOS				
ITEM	**QUANTITY**	**UNIT**	**UNIT COST**	**COST**
DEMOLITION/RESTORATION				
REMOVE EXISTING INLET	13	EA	$800	$10,400
REMOVE/REPLACE EXISTING STREET PAVEMENT	2667	SY	$68	$180,667
REMOVE/REPLACE STANDARD CURB & GUTTER	1940	LF	$30	$58,200
REMOVE/REPLACE RESIDENTIAL DRIVEWAY	167	SY	$60	$10,000
REMOVE/REPLACE ALLEYWAY DRIVE	89	SY	$86	$7,644
REMOVE/REPLACE WALKWAY - STAIRS	17	EA	$1,800	$30,600
REMOVE & REPLACE SIDEWALK	3840	SF	$11	$42,240
CONSTRUCT NEW SIDEWALK	3840	SF	$10	$38,400
CONSTRUCT NEW ADA RAMP	37	EA	$350	$12,950
STORM SEWER CONSTRUCTION				
STORMWATER PIPE - 15" RCP	1960	LF	$97	$189,140
STORMWATER PIPE - 30" RCP	320	LF	$114	$36,480
CURB INLET	16	EA	$5,000	$80,000
STORMWATER MANHOLE	7	EA	$5,000	$35,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION				
EXCAVATION (ON-SITE GRADING)	1253	CY	$4	$5,012
FILL (ON-SITE GRADING)	1502	CY	$2	$3,004
GREEN OUTLET CONTROL	1	EA	$1,000	$1,000
LANDSCAPING				
SOD	1879	SY	$7	$13,156
			SUBTOTAL	**$754,000**
GENERAL CONSTRUCTION				
E&S CONTROL	5%			$38,000
TRAFFIC CONTROL	2%			$15,000
ENGINEERING DESIGN	15%			$113,000
CONTIGENCY	25%			$230,000
PHASE 4 TOTAL (Rounded to the nearest $100k)				**$1,200,000**

UNIFIED GREEN PHASE 1 CONCEPTUAL DESIGN OPINION OF PROBABLE COST: 25-Year LOS				
ITEM	**QUANTITY**	**UNIT**	**UNIT COST**	**COST**
DEMOLITION/RESTORATION				
BUILDING DEMOLITION	1	LS	$78,600	$78,600
REMOVE EXISTING INLET	29	EA	$800	$23,200
REMOVE/REPLACE EXISTING STREET PAVEMENT	5560	SY	$68	$376,690
REMOVE/REPLACE STANDARD CURB & GUTTER	5490	LF	$30	$164,700
REMOVE/REPLACE COMMERCIAL DRIVEWAY	933	SY	$86	$80,267
REMOVE/REPLACE RESIDENTIAL DRIVEWAY	83	SY	$60	$5,000
REMOVE/REPLACE WALKWAY - STAIRS	15	EA	$1,800	$27,000
REMOVE & REPLACE SIDEWALK	29960	SF	$11	$329,560
CONSTRUCT NEW ADA RAMP	38	EA	$350	$13,300
STORM SEWER CONSTRUCTION				
STORMWATER PIPE - 15" RCP	200	LF	$97	$19,300
STORMWATER PIPE - 48" RCP	840	LF	$207	$173,880
STORMWATER PIPE - 84" RCP	810	LF	$410	$332,100
CURB INLET	20	EA	$5,000	$100,000
STORMWATER MANHOLE	7	EA	$5,000	$35,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION				
ENGINEERED SOIL MIX	2861	CY	$30	$85,837
PERMEABLE PAVERS	39804	SF	$12	$477,647
STORAGE AGGREGATE (NO. 57)	8511	TON	$30	$255,323
CHOKER COURSE (NO. 8)	572	CY	$20	$11,445
GEOMEMBRANE	1783	SY	$25	$44,583
UNDERDRAIN - 6" PERFORATED PVC	3560	LF	$19	$67,640
PVC CLEANOUT	17	EA	$70	$1,190
GREEN OUTLET CONTROL	15	EA	$1,000	$15,000
STORMWATER PRETREATMENT DEVICE	1	EA	$190,000	$190,000
RIBBON CURB	2550	LF	$15	$38,250
LANDSCAPING				
BIORETENTION LANDSCAPING	30901	SF	$8	$247,211
			SUBTOTAL	**$3,193,000**
GENERAL CONSTRUCTION				
PROPERTY ACQUISITION	1	LS	$262,000	$262,000
E&S CONTROL	5%			$160,000
TRAFFIC CONTROL	2%			$64,000
ENGINEERING DESIGN	15%			$479,000
CONTIGENCY	25%			$1,040,000
			PHASE 1 TOTAL (Rounded to the nearest $100k)	**$5,200,000**

UNIFIED GREEN PHASE 2 CONCEPTUAL DESIGN OPINION OF PROBABLE COST: 25-Year LOS				
ITEM	**QUANTITY**	**UNIT**	**UNIT COST**	**COST**
DEMOLITION/RESTORATION				
REMOVE EXISTING INLET	13	EA	$800	$10,400
REMOVE/REPLACE EXISTING STREET PAVEMENT	1920	SY	$68	$130,080
REMOVE/REPLACE STANDARD CURB & GUTTER	1380	LF	$30	$41,400
REMOVE & REPLACE SIDEWALK	5760	SF	$11	$63,360
CONSTRUCT NEW ADA RAMP	4	EA	$350	$1,400
REMOVE EXISTING TREE	5	EA	$1,500	$7,500
STORM SEWER CONSTRUCTION				
STORMWATER PIPE - 15" RCP	60	LF	$97	$5,790
CURB INLET	6	EA	$5,000	$30,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION				
FILL (ON-SITE GRADING)	3142	CY	$2	$6,284
ENGINEERED SOIL MIX	628	CY	$30	$18,832
PERMEABLE PAVERS	6774	SF	$12	$81,287
STORAGE AGGREGATE (NO. 57)	677	TON	$30	$20,322
CHOKER COURSE (NO. 8)	126	CY	$20	$2,511
GEOMEMBRANE	647	SY	$25	$16,181
UNDERDRAIN - 6" PERFORATED PVC	1110	LF	$19	$21,090
PVC CLEANOUT	4	EA	$70	$280
GREEN OUTLET CONTROL	2	EA	$1,000	$2,000
LAKE OUTLET CONTROL STRUCTURE	1	EA	$50,000	$50,000
OPTI REAL-TIME CONTROL	1	EA	$51,626	$51,626
6" REINFORCED CONCRETE CAP (BIG 11 LAKE)	20	CY	$400	$7,815
MODULAR BLOCK WALL	3167	SFF	$55	$174,167
RIBBON CURB	600	LF	$15	$9,000
TIED CONCRETE BLOCK MAT	1208	SY	$80	$96,676
LANDSCAPING				
2" CALIPER TREES	15	EA	$500	$7,500
BIORETENTION LANDSCAPING	6780	SF	$8	$54,236
			SUBTOTAL	**$910,000**
GENERAL CONSTRUCTION				
E&S CONTROL	5%			$46,000
TRAFFIC CONTROL	2%			$18,000
ENGINEERING DESIGN	15%			$137,000
CONTIGENCY	25%			$278,000
PHASE 2 TOTAL (Rounded to the nearest $100k)				**$1,400,000**

UNIFIED GREEN PHASE 3 CONCEPTUAL DESIGN OPINION OF PROBABLE COST: 25-Year LOS				
ITEM	**QUANTITY**	**UNIT**	**UNIT COST**	**COST**
DEMOLITION/RESTORATION				
BUILDING DEMOLITION	1	LS	$50,700	$50,700
REMOVE EXISTING INLET	9	EA	$800	$7,200
REMOVE/REPLACE EXISTING STREET PAVEMENT	1120	SY	$68	$75,880
REMOVE/REPLACE STANDARD CURB & GUTTER	780	LF	$30	$23,400
REMOVE/REPLACE COMMERCIAL DRIVEWAY	89	SY	$86	$7,644
REMOVE/REPLACE ALLEYWAY DRIVE	22	SY	$86	$1,911
REMOVE & REPLACE SIDEWALK	2440	SF	$11	$26,840
CONSTRUCT NEW SIDEWALK	560	SF	$10	$5,600
CONSTRUCT NEW ADA RAMP	24	EA	$350	$8,400
STORM SEWER CONSTRUCTION				
STORMWATER PIPE - 15" RCP	110	LF	$97	$10,615
STORMWATER PIPE - 30" RCP	270	LF	$114	$30,780
STORMWATER PIPE - 54" RCP	290	LF	$239	$69,310
STORMWATER PIPE - 60" RCP	340	LF	$330	$112,200
STORMWATER PIPE - 72" RCP	430	LF	$350	$150,500
CURB INLET	11	EA	$5,000	$55,000
STORMWATER MANHOLE	11	EA	$5,000	$55,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION				
EXCAVATION (ON-SITE GRADING)	5285	CY	$4	$21,141
FILL (ON-SITE GRADING)	2061	CY	$2	$4,122
ENGINEERED SOIL MIX	1043	CY	$30	$31,291
STORAGE AGGREGATE (NO. 57)	1760	TON	$30	$52,804
CHOKER COURSE (NO. 8)	209	CY	$20	$4,172
STORMTECH UNDERGROUND STORAGE	67082	CF	$8	$536,659
UNDERDRAIN - 6" PERFORATED PVC	400	LF	$19	$7,600
PVC CLEANOUT	4	EA	$70	$280
GREEN OUTLET CONTROL	4	EA	$1,000	$4,000
LANDSCAPING				
BIORETENTION LANDSCAPING	11265	SF	$8	$90,118
SOD	3171	SY	$7	$22,198
			SUBTOTAL	**$1,465,000**
GENERAL CONSTRUCTION				
PROPERTY ACQUISITION	1	LS	$169,000	$169,000
E&S CONTROL	5%			$73,000
TRAFFIC CONTROL	2%			$29,000
ENGINEERING DESIGN	15%			$220,000
CONTIGENCY	25%			$489,000
PHASE 3 TOTAL (Rounded to the nearest $100k)				**$2,500,000**

UNIFIED GREEN PHASE 4 CONCEPTUAL DESIGN OPINION OF PROBABLE COST: 25-Year LOS				
ITEM	**QUANTITY**	**UNIT**	**UNIT COST**	**COST**
DEMOLITION/RESTORATION				
REMOVE EXISTING INLET	13	EA	$800	$10,400
REMOVE/REPLACE EXISTING STREET PAVEMENT	2667	SY	$68	$180,667
REMOVE/REPLACE STANDARD CURB & GUTTER	1940	LF	$30	$58,200
REMOVE/REPLACE RESIDENTIAL DRIVEWAY	167	SY	$60	$10,000
REMOVE/REPLACE ALLEYWAY DRIVE	89	SY	$86	$7,644
REMOVE/REPLACE WALKWAY - STAIRS	17	EA	$1,800	$30,600
REMOVE & REPLACE SIDEWALK	3840	SF	$11	$42,240
CONSTRUCT NEW SIDEWALK	3840	SF	$10	$38,400
CONSTRUCT NEW ADA RAMP	37	EA	$350	$12,950
STORM SEWER CONSTRUCTION				
STORMWATER PIPE - 15" RCP	160	LF	$97	$15,440
STORMWATER PIPE - 30" RCP	1800	LF	$114	$205,200
STORMWATER PIPE - 48" RCP	320	LF	$207	$66,240
CURB INLET	16	EA	$5,000	$80,000
STORMWATER MANHOLE	7	EA	$5,000	$35,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION				
EXCAVATION (ON-SITE GRADING)	1253	CY	$4	$5,012
FILL (ON-SITE GRADING)	1502	CY	$2	$3,004
GREEN OUTLET CONTROL	1	EA	$1,000	$1,000
LANDSCAPING				
SOD	1879	SY	$7	$13,156
			SUBTOTAL	**$815,000**
GENERAL CONSTRUCTION				
E&S CONTROL	5%			$41,000
TRAFFIC CONTROL	2%			$16,000
ENGINEERING DESIGN	15%			$122,000
CONTIGENCY	25%			$249,000
PHASE 4 TOTAL (Rounded to the nearest $100k)				**$1,300,000**

APPENDIX D – UNIFIED GREEN WORKSHOP PRESENTATION
JANUARY 25, 2018

Unified Green

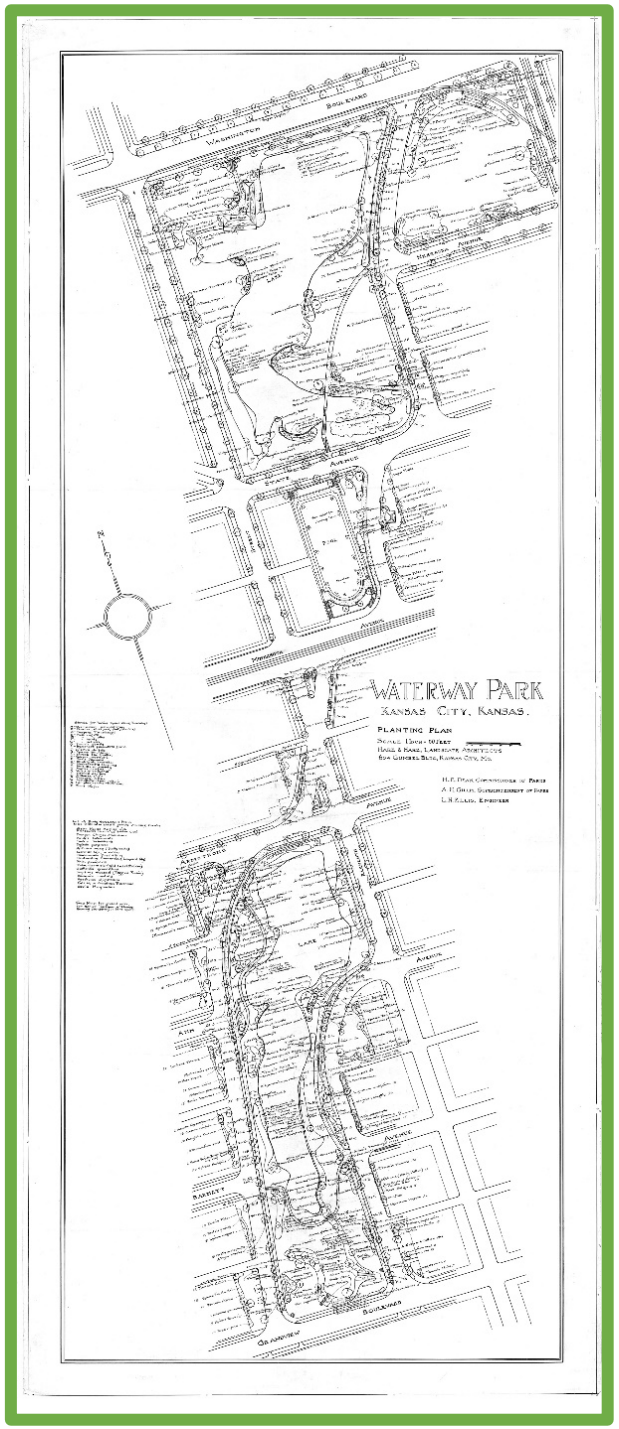
Concept Design for Green Stormwater Infrastructure at Big Eleven Lake & Waterway Park

January 25, 2018

Integrated Overflow Control Plan

Unified Green Goals:

- Reduce overflow at CSO 19
- Maximize the function and benefit of Big 11 Lake
- Demonstrate and pilot Green Stormwater Infrastructure (GSI) technologies:
  - Distributed
  - Centralized
  - Restore natural drainage ways
- Integrate with the community

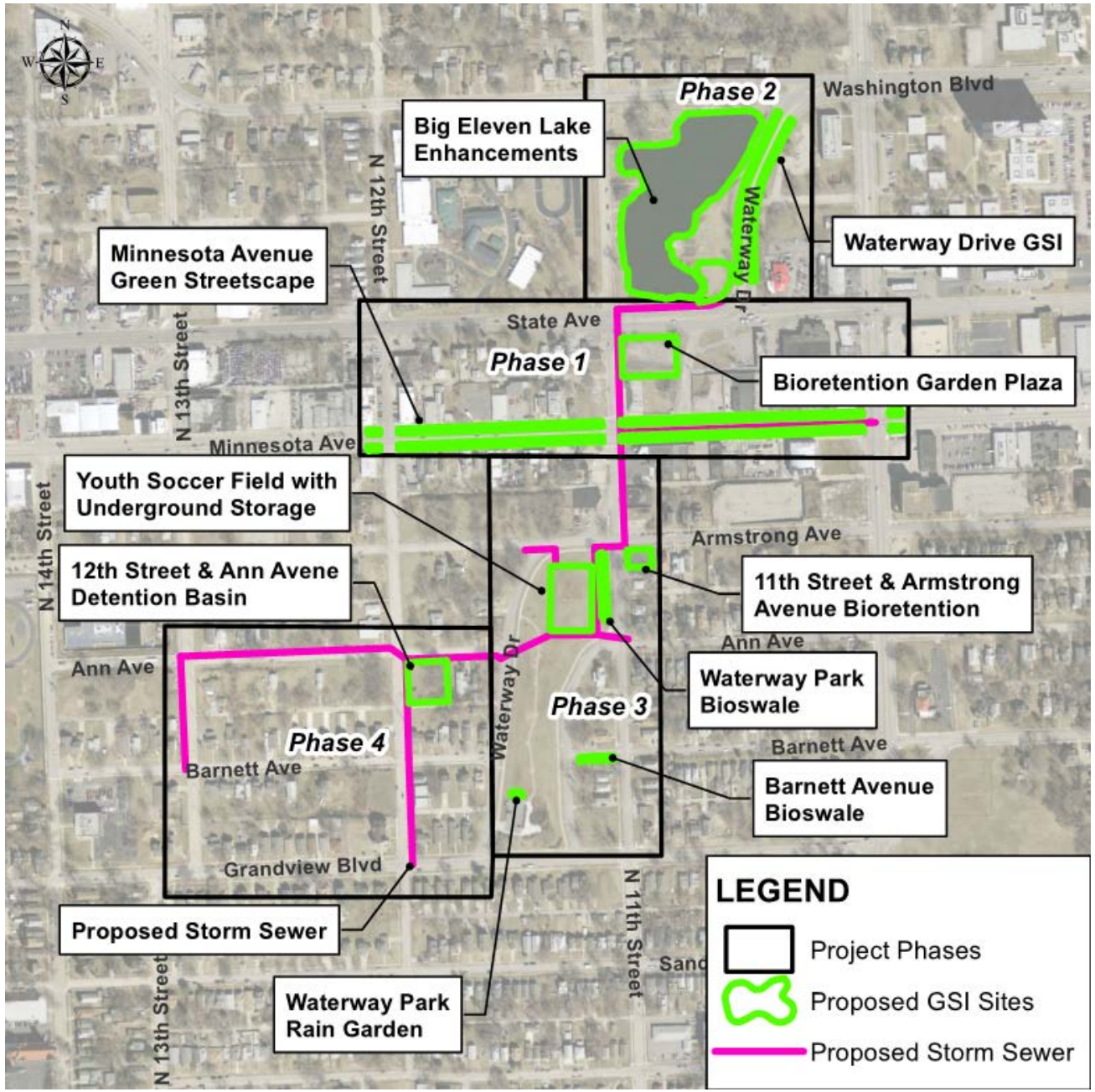


Green Stormwater Infrastructure is

Multi-Benefit Infrastructure

GSI is often a surface feature with a stormwater benefit. However, these projects also:

- *Reduce stormwater to CSO 19*
- *Enhance and connect parks*
- *Define the roadway cross section*
- *Align with community plans*
- *Promote economic development and environmental justice*
- *Educate the community*
- *Provide a 'pilot' opportunity for GSI Construction, Maintenance, and Monitoring*



Today's Workshop:

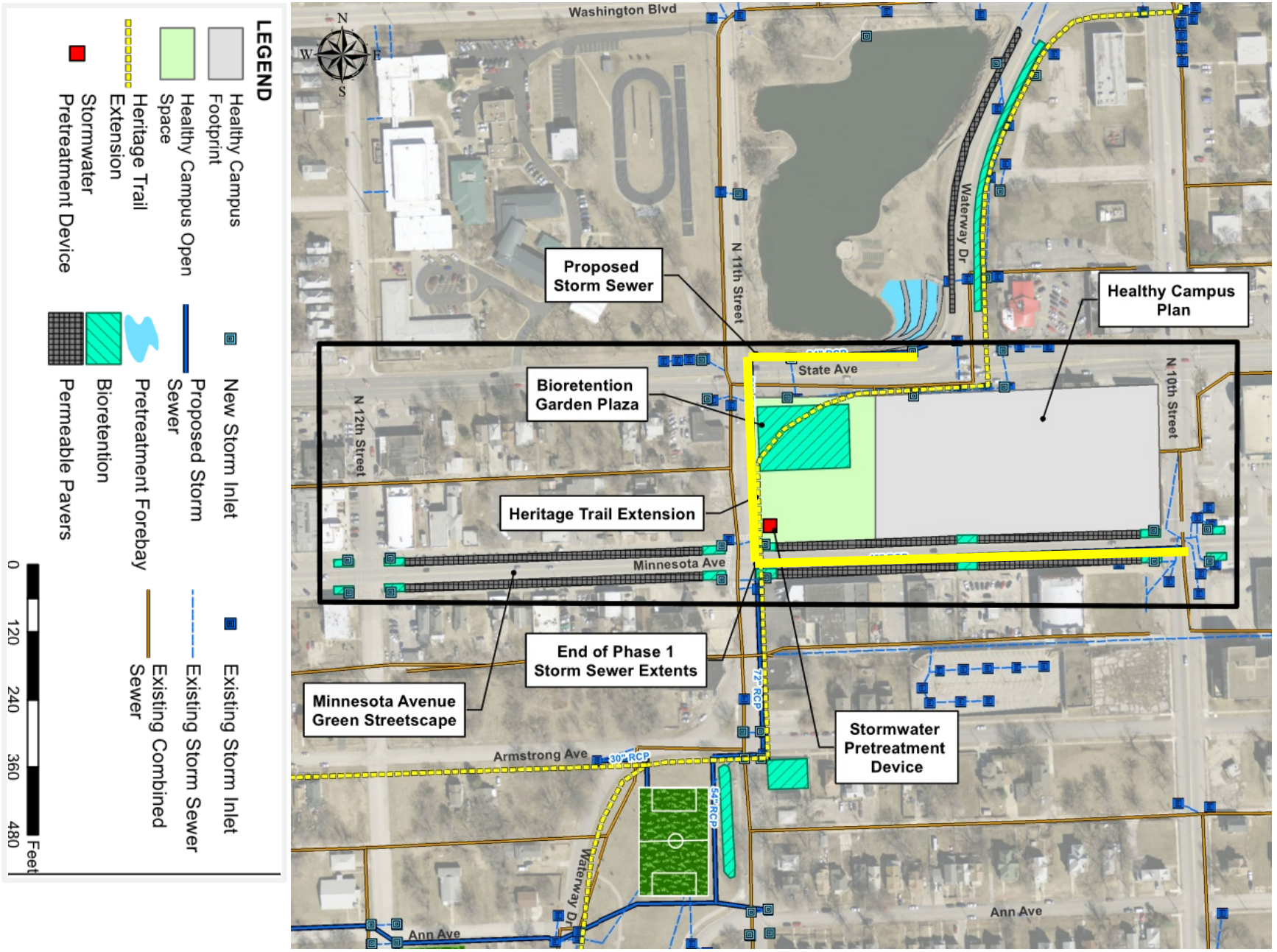
- These are possibilities:
  - Look can vary
  - Not all GSI must be constructed to meet IOCP
  - Proposed phasing can be modified
- Consider below and above surface
- Consider what this area 'could' look like

Basics:

- Stormwater flows overland near pink line
- Existing Big 11 Lake does not currently have a stormwater connection
- Existing area served by combined sewer
  - Capacity less than annual event (2.86 inches in 24-hours)

BURNS McDONNELL

Unified Green Phase 1: Storm Sewer Separation



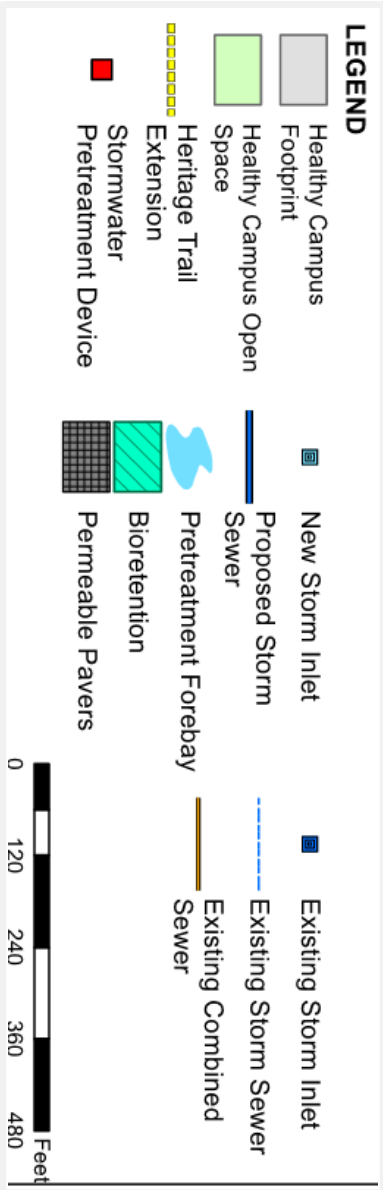
Key Features:

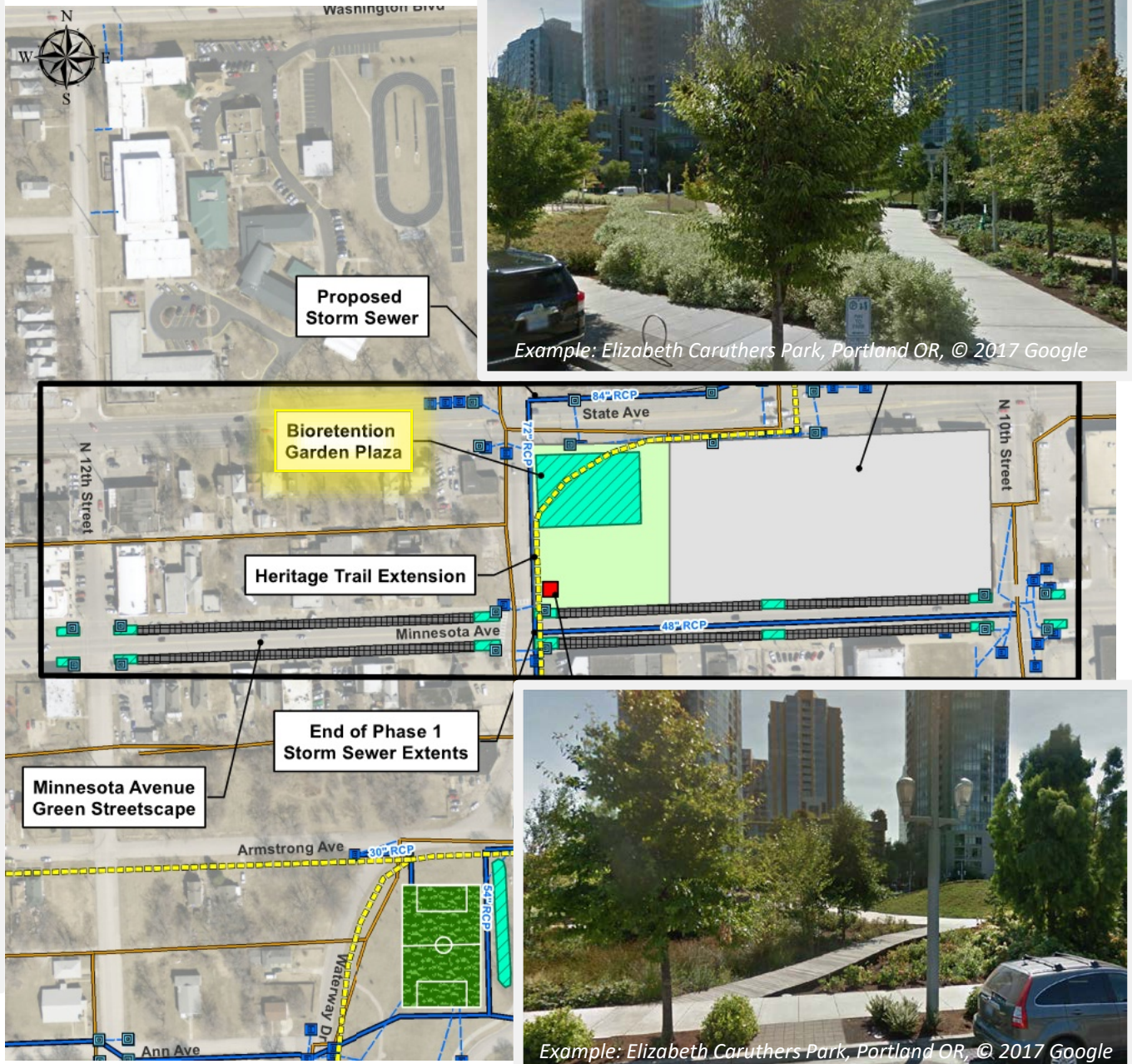
- New stormwater interceptor from 11th and Minnesota to the SE corner of Big 11 Lake
  - *Level of service TBD*
- Replace existing storm pipe on Minnesota, from 10th to 11th
  - *Level of service TBD*
- Remove / strategically place new inlets
- Temporary connection to combined system

Multi-Benefits

- *Reduce stormwater to priority outfall*

Unified Green Phase 1: Bioretention Garden Plaza





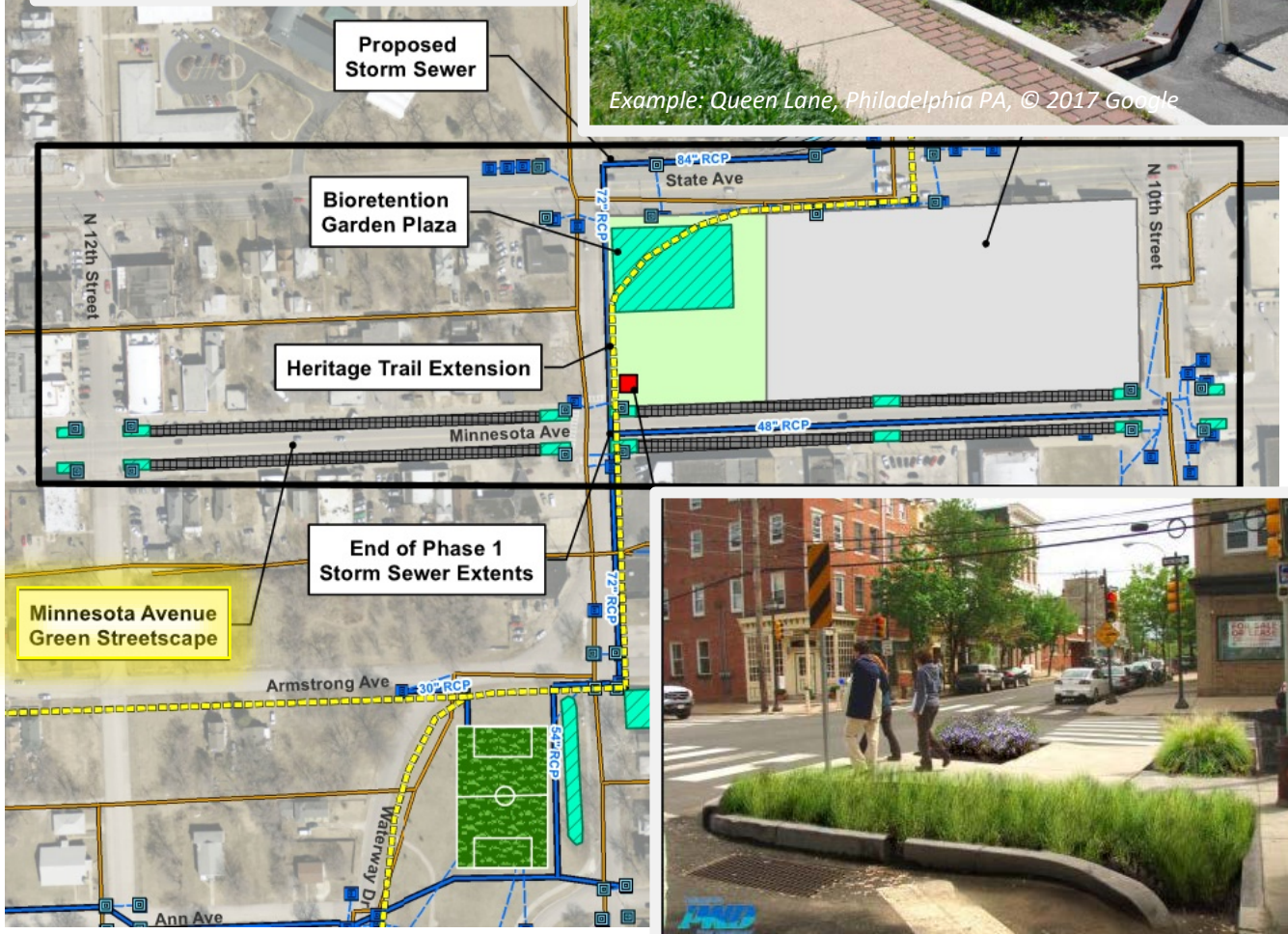
Key Features:

- Low flows diverted from new storm line
- Design Parameters
  - 0.50 acre footprint
  - Ponding depth = 6”
  - Media depth = 30”
  - Aggregate depth = 12”
  - Control Acres = 11

Multi-Benefits

- *Enhance and connect parks*
- *Align with community plans*
- *Pilot GSI*

Unified Green Phase 1: Minnesota Ave Green Streetscape



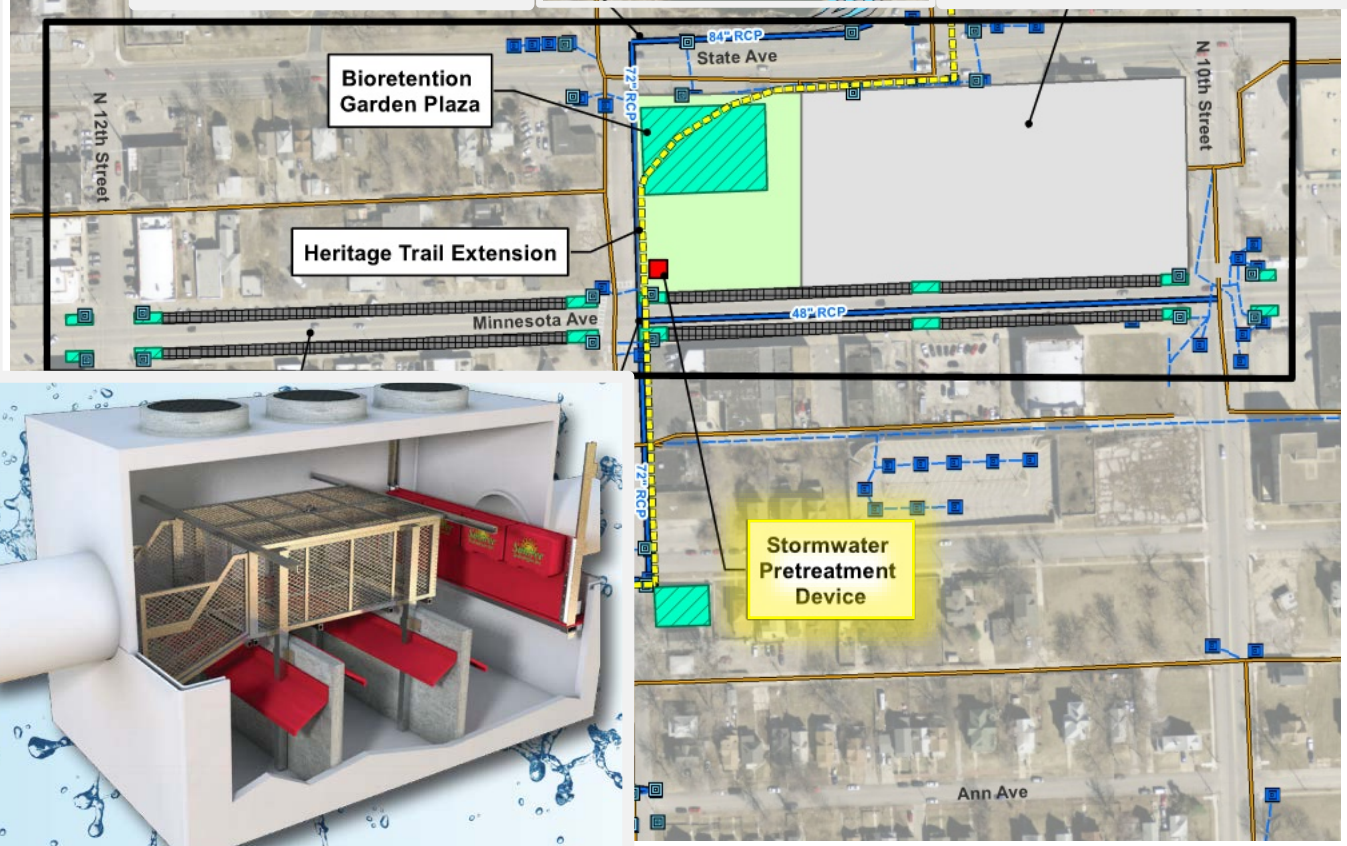
Key Features:

- Green streetscape from 10th to 12th
- Mid block and corner bump out bioretention – pedestrian safety
- Permeable paver parking
- Design Parameters
  - 1.10 acre green area
  - Control Acres = 14
  - *Bioretention*
    - Ponding depth = 6”
    - Media depth = 30”
    - Aggregate depth = 12”
  - *Permeable Pavement*
    - Aggregate depth = 36”

Multi-Benefits

- *Define the roadway cross section*
- *Align with community plans*
- *Promote economic development and environmental justice*
- *Pilot GSI*

Unified Green Phase 1: Stormwater Pretreatment Device



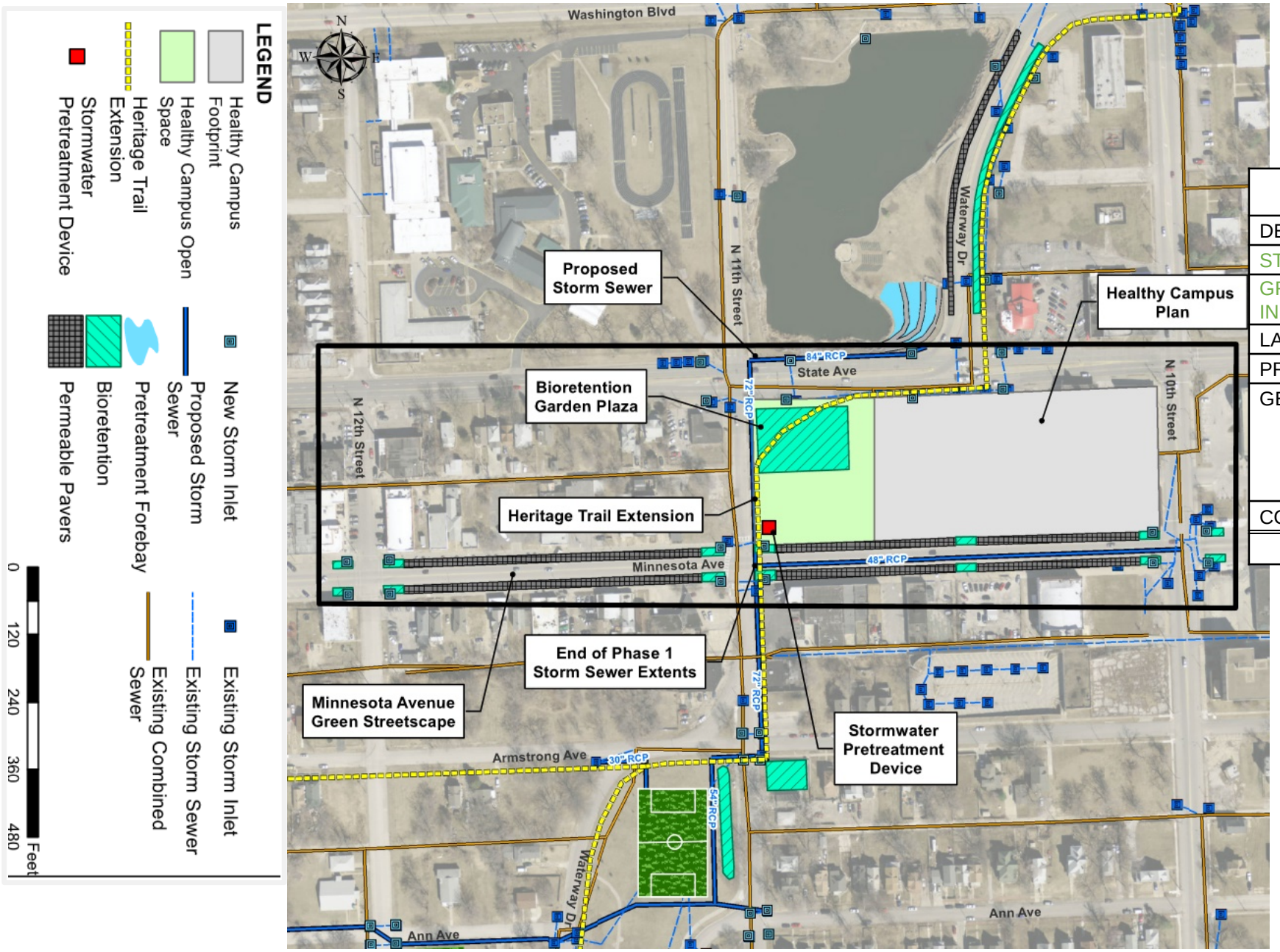
Key Features:

- Remove trash and sediment upstream of
  - Bioretention Garden Plaza
  - Big 11 Lake
- Design Parameters
  - *Remove trash and floatables*
  - *Sediment settling chambers*

Multi-Benefits

- *Pilot GSI, Maintenance*

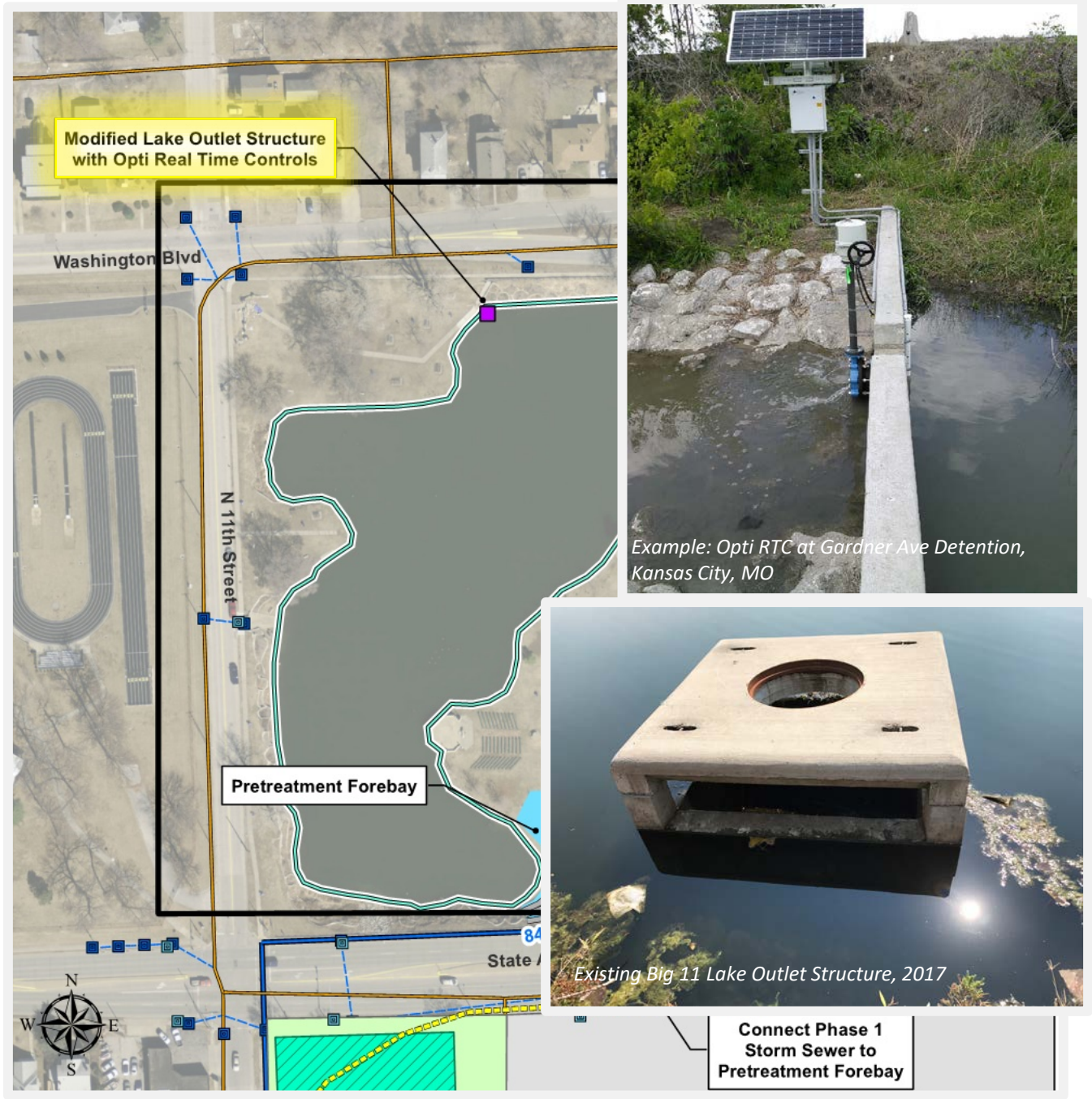
Unified Green Phase 1: Opinion of Probable Cost Summary



COST SUMMARY CATEGORY	PHASE 1: Range of Cost	
DEMOLITION/RESTORATION	$1,098,000	$1,098,000
STORM SEWER CONSTRUCTION	$422,000	$660,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION	$1,187,000	$1,187,000
LANDSCAPING	$248,000	$248,000
PROPERTY ACQUISITION	$262,000	$262,000
GENERAL CONSTRUCTION E&S Control – 5% Traffic Control – 2% Engineering Design – 15%	$650,000	$703,000
CONTINGENCY (25%)	$967,000	$1,040,000
TOTAL	**$4,900,000**	**$5,200,000**

- Cost per Gallon (680,000 gal)
  - $7.65 Total Phase
- Cost per Control Acre (25 acres)
  - $200,000 Total Phase

Unified Green Phase 2: Big 11 Lake Outlet Structure Retrofit



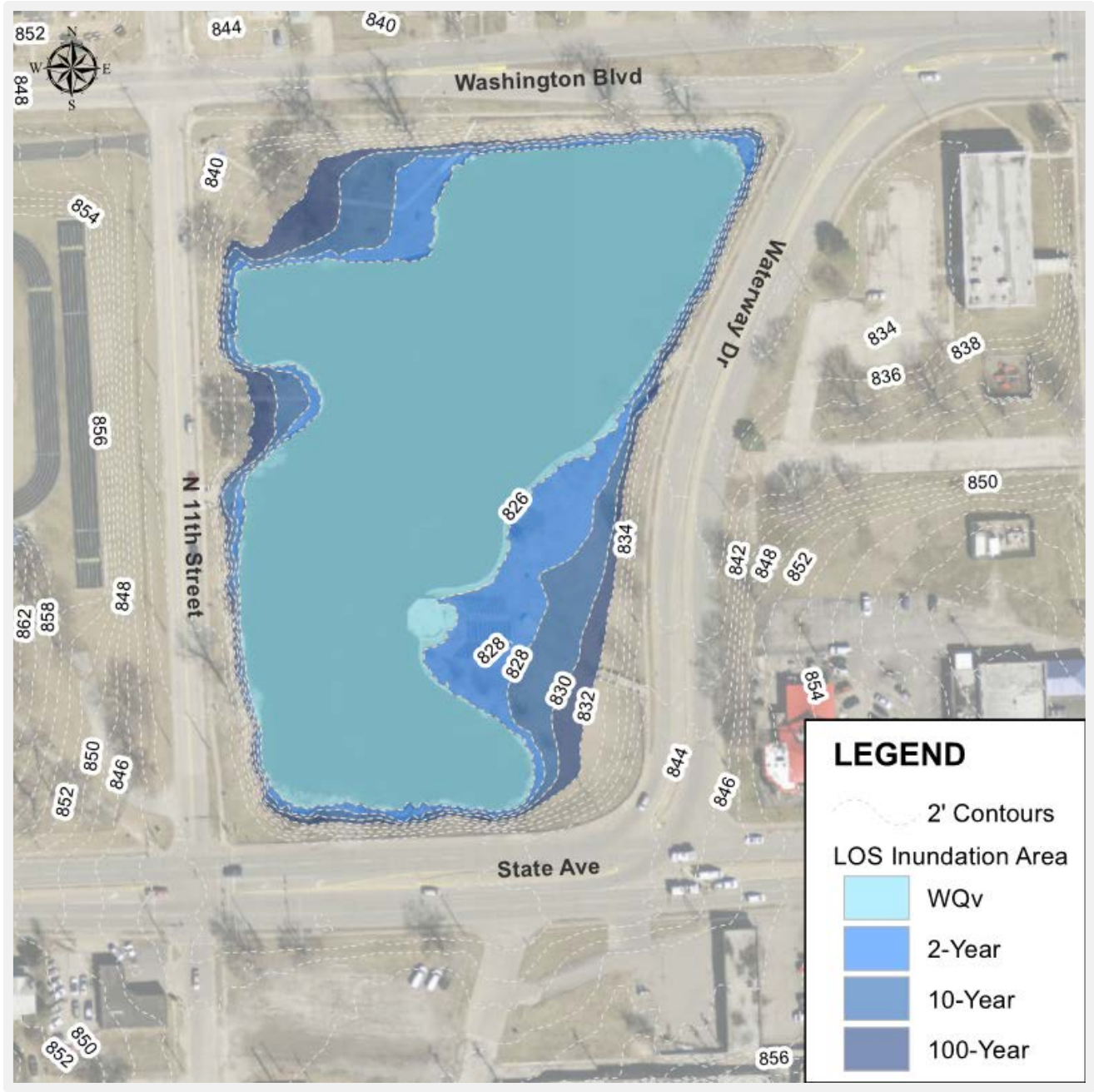
Example: Opti RTC at Gardner Ave Detention, Kansas City, MO

Existing Big 11 Lake Outlet Structure, 2017

Key Features:

- Modify outlet structure
- Restore existing lake edge
- Install Opti RTC
  - Dewater 24 to 48 hours
  - Automated valve control connected to NOAA forecasting
- Design Parameters
  - For storm events greater than WQv, storage assumes runoff from entire 114 acres
- Control Inundation Area

Unified Green Phase 2: Big 11 Lake Outlet Structure Retrofit



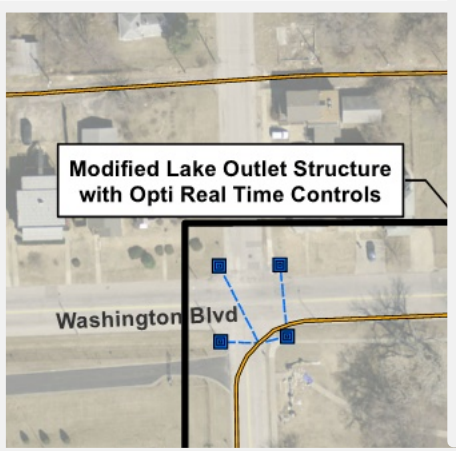
Key Features:

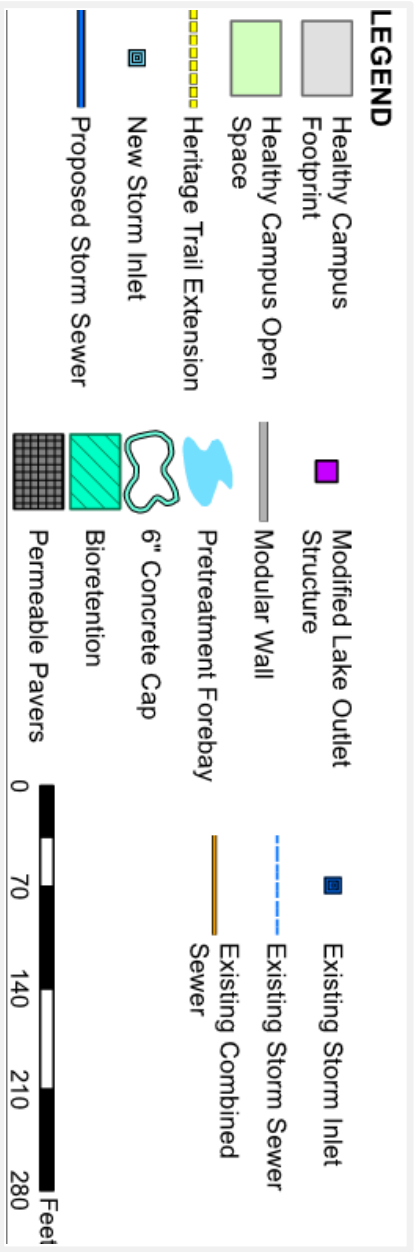
- Inundation Area

Multi-Benefits

- *Reduce stormwater to outfall*
- *Pilot technology in UG*

Unified Green Phase 2: Big 11 Lake Pretreatment Forebay





Key Features:

- 3-tiered serpentine flow path
  - Mimic existing stone walls
- Discharge to southeast corner of Big 11 Lake
- Wetland plantings
- Removed temporary combined sewer connection
- Design Parameters
  - Storage above the permanent pool

Multi-Benefits

- *Reduce stormwater to outfall*
- *Enhance and connect parks*
- *Align with community plans*

Unified Green Phase 2: Waterway Drive

Key Features:

- Vacating all/portion of Waterway Dr
- Assumptions
  - *West outer lane = permeable paver parking*
  - *East outer lane = bioretention*
- Design Parameters
  - 0.30 acre green area
  - *Bioretention*
    - Ponding depth = 6”
    - Media depth = 30”
  - *Permeable Pavement*
    - Aggregate depth = 24”
  - Control Acres = 4

Multi-Benefits

- *Enhance and connect parks*
- *Align with community plans*
- *Pilot GSI*

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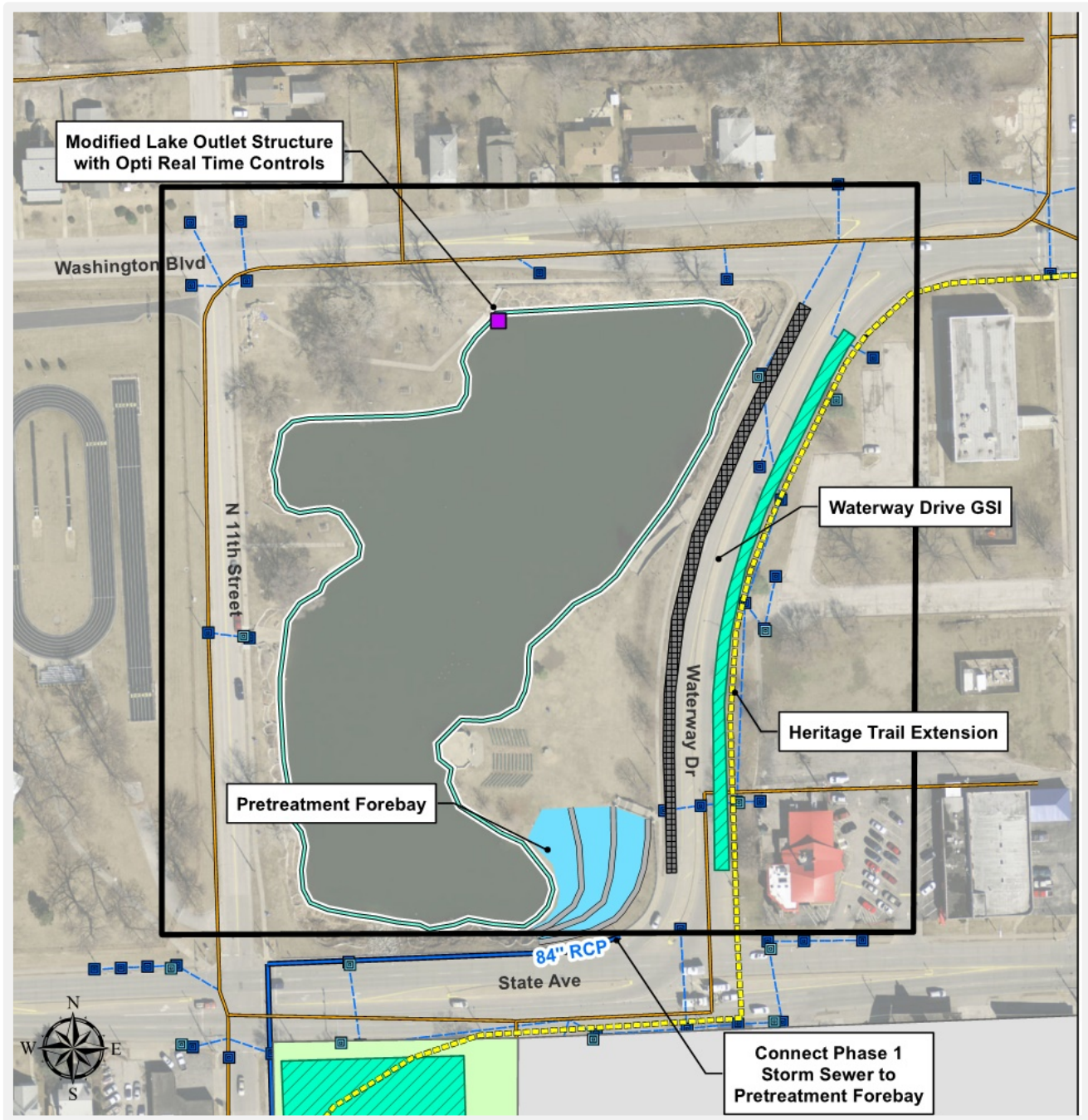

LEGEND

- Healthy Campus Footprint
- Healthy Campus Open Space
- Heritage Trail Extension
- New Storm Inlet
- Proposed Storm Sewer
- Modified Lake Outlet Structure
- Modular Wall
- Pretreatment Forebay
- 6" Concrete Cap
- Bioretention
- Permeable Pavers
- Existing Storm Inlet
- Existing Storm Sewer
- Existing Combined Sewer

0 70 140 210 280 Feet

Unified Green Phase 2: Opinion of Probable Cost Summary

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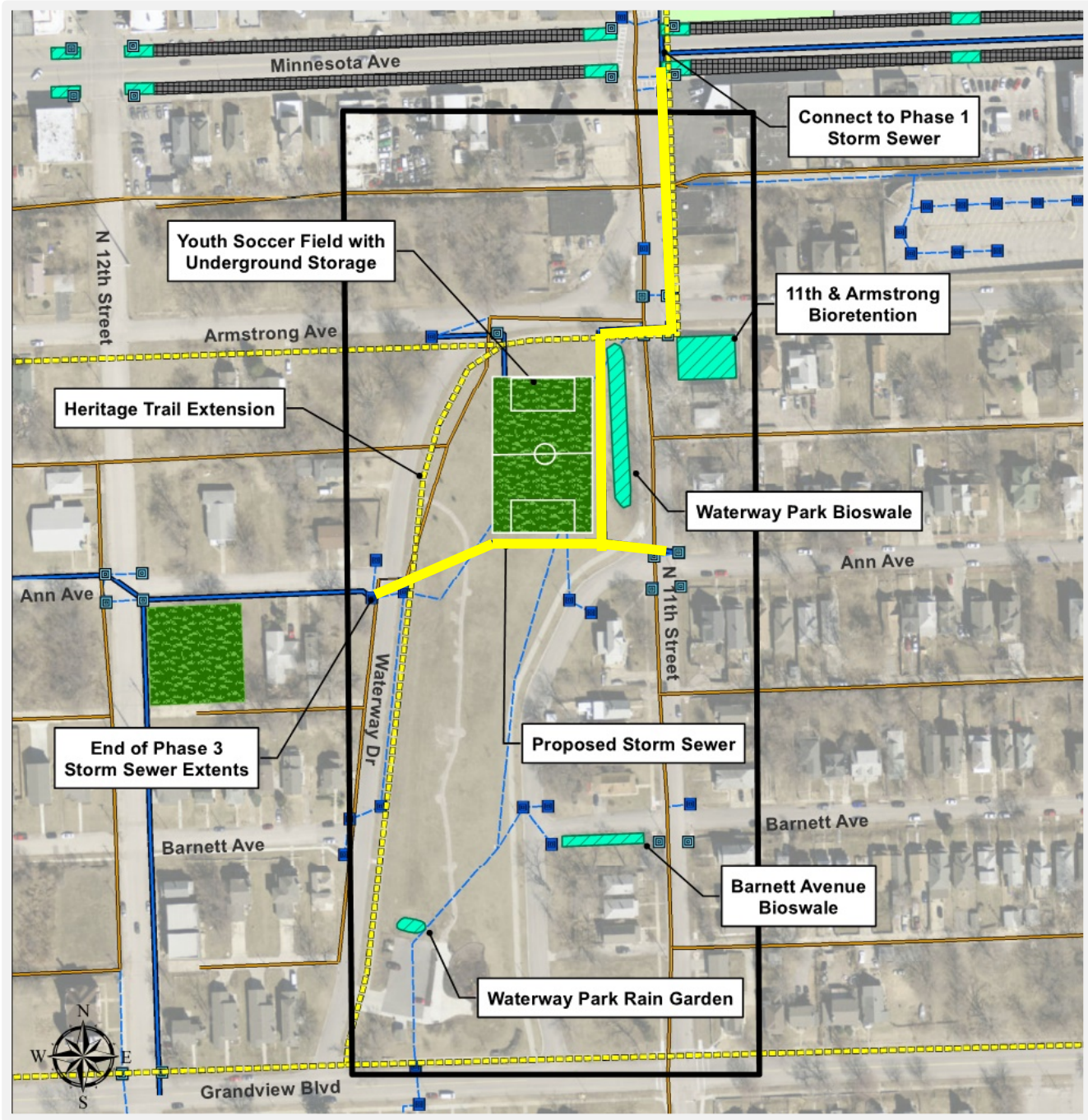
COST SUMMARY CATEGORY	PHASE 2 Cost
DEMOLITION/RESTORATION	$254,000
STORM SEWER CONSTRUCTION	$36,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION	$558,000
LANDSCAPING	$62,000
PROPERTY ACQUISITION	-
GENERAL CONSTRUCTION E&S Control – 5% Traffic Control – 2% Engineering Design – 15%	$201,000
CONTINGENCY (25%)	$278,000
TOTAL	**$1,400,000**

- Cost per Gallon (765,800 gal)
  - $1.83 Total Phase
- Cost per Control Acre (29 acres)
  - $50,000 Total Phase

Unified Green Phase 3: Storm Sewer Separation



Key Features:

- New stormwater interceptor from 11th and Minnesota south to Waterway Park
  - *Level of service TBD*
- Connect to existing storm in Waterway Park
- Extend to Ann Ave
- Remove / strategically place new inlets

Multi-Benefits

- *Reduce stormwater to priority outfall*

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Unified Green Phase 3: 11th & Armstrong Bioretention

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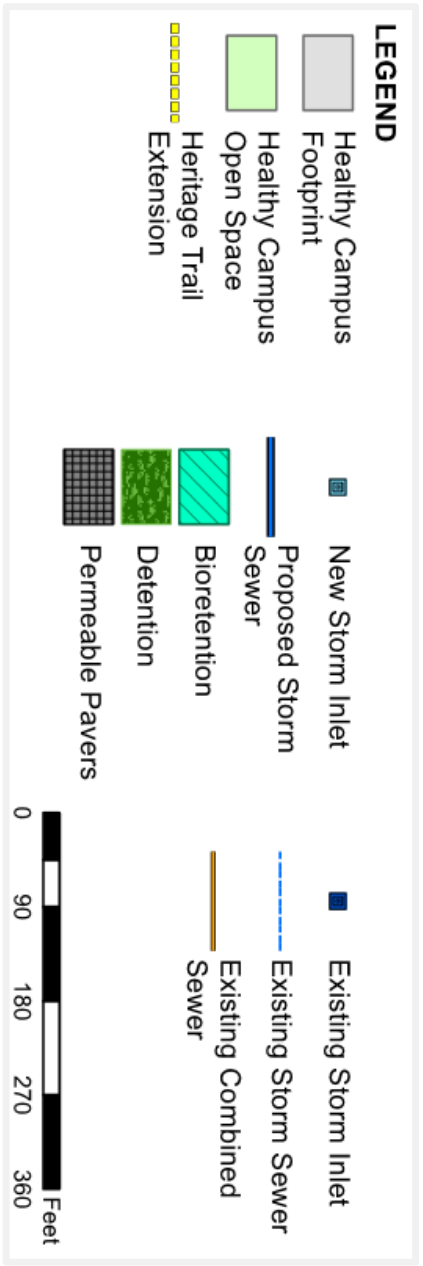

Key Features:

- Low flows diverted from street and new storm line
- Design Parameters
  - 0.10 acre green area
  - Ponding depth = 12”
  - Media depth = 36”
  - Aggregate depth = 18”
  - Control Acres = 4.5

Multi-Benefits

- *Enhance and connect parks*
- *Align with community plans*
- *Pilot GSI*

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Unified Green Phase 3: Youth Soccer Field with Underground Storage

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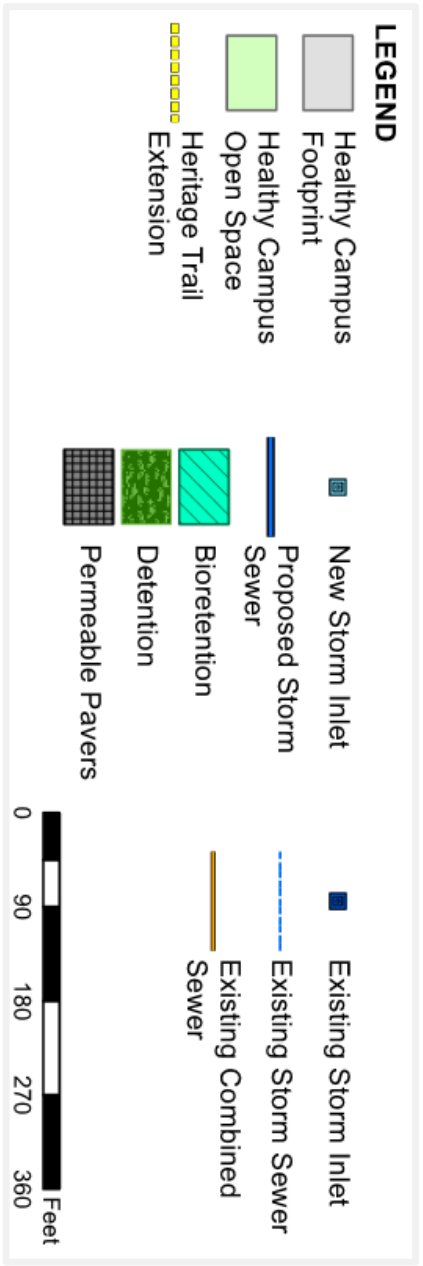
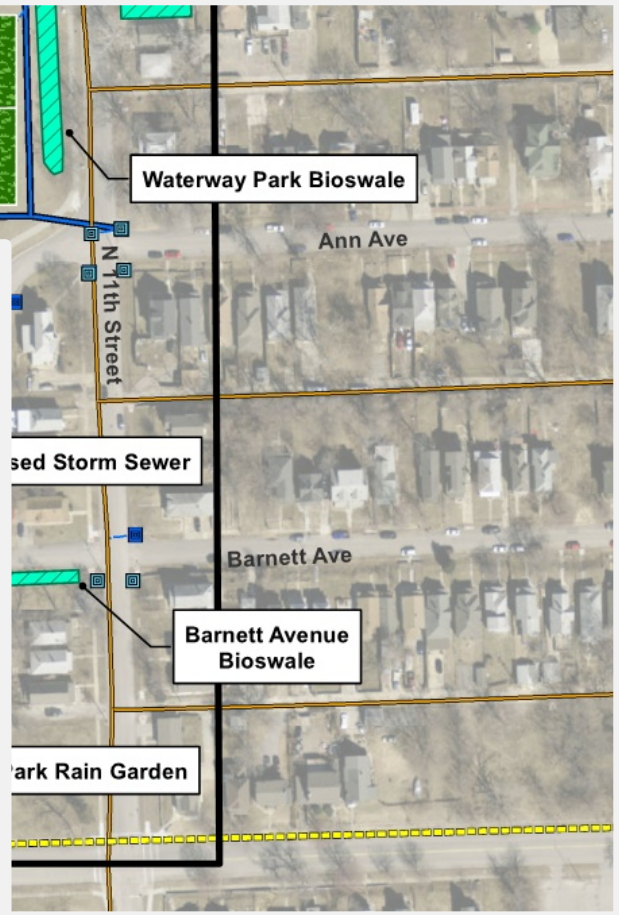



Example: Underground Storage, adswater.com


Example: Play field integrated with GSI, 81st & Troost, Kansas City, MO



Key Features:

- Divert storm flows for underground storage / infiltration
- Dewater to new storm line
- Integrates with existing Park use
- Design Parameters
  - 0.66 acre green area
  - ADS StormTech SC-740
  - Control Acres = 33

Multi-Benefits

- *Enhance and connect parks*
- *Align with community plans*
- *Pilot GSI*

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Unified Green Phase 3: Barnett Avenue Bioswale

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Key Features:

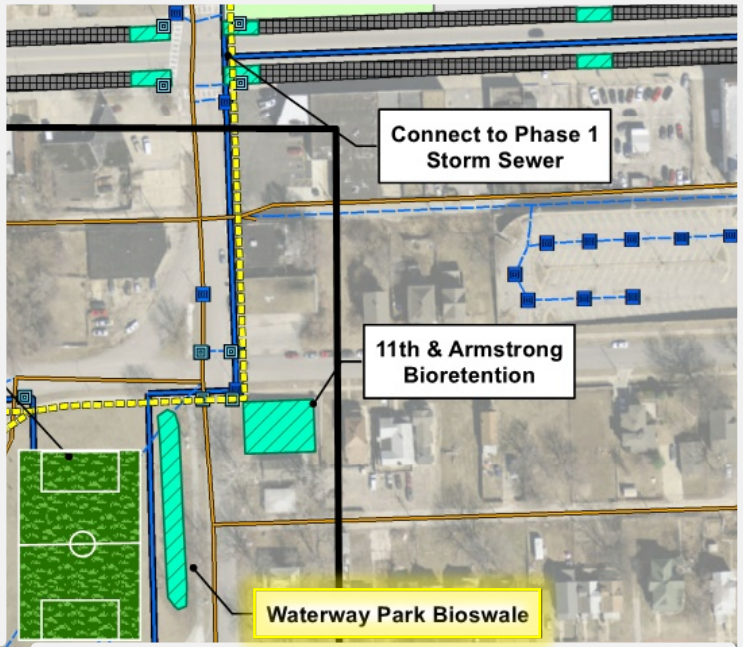
- Conveyance and pre-treatment mechanism

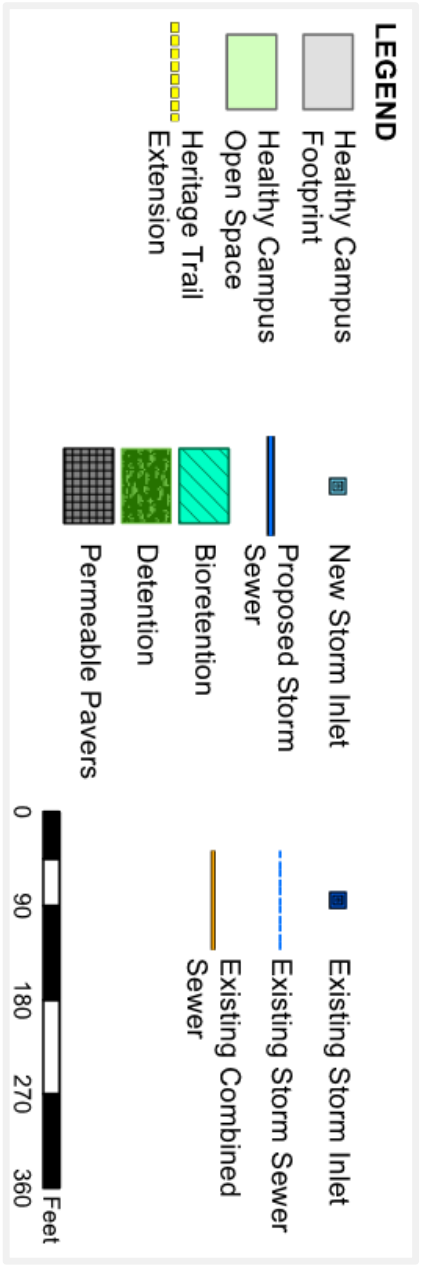
- Design Parameters
  - 0.04 acre area
  - Ponding depth = 6”
  - Media depth = 30”
  - Aggregate depth = 12”
  - Control Acres = 2.20

Multi-Benefits

- *Pilot GSI*

Unified Green Phase 3: Waterway Park GSI Retrofits





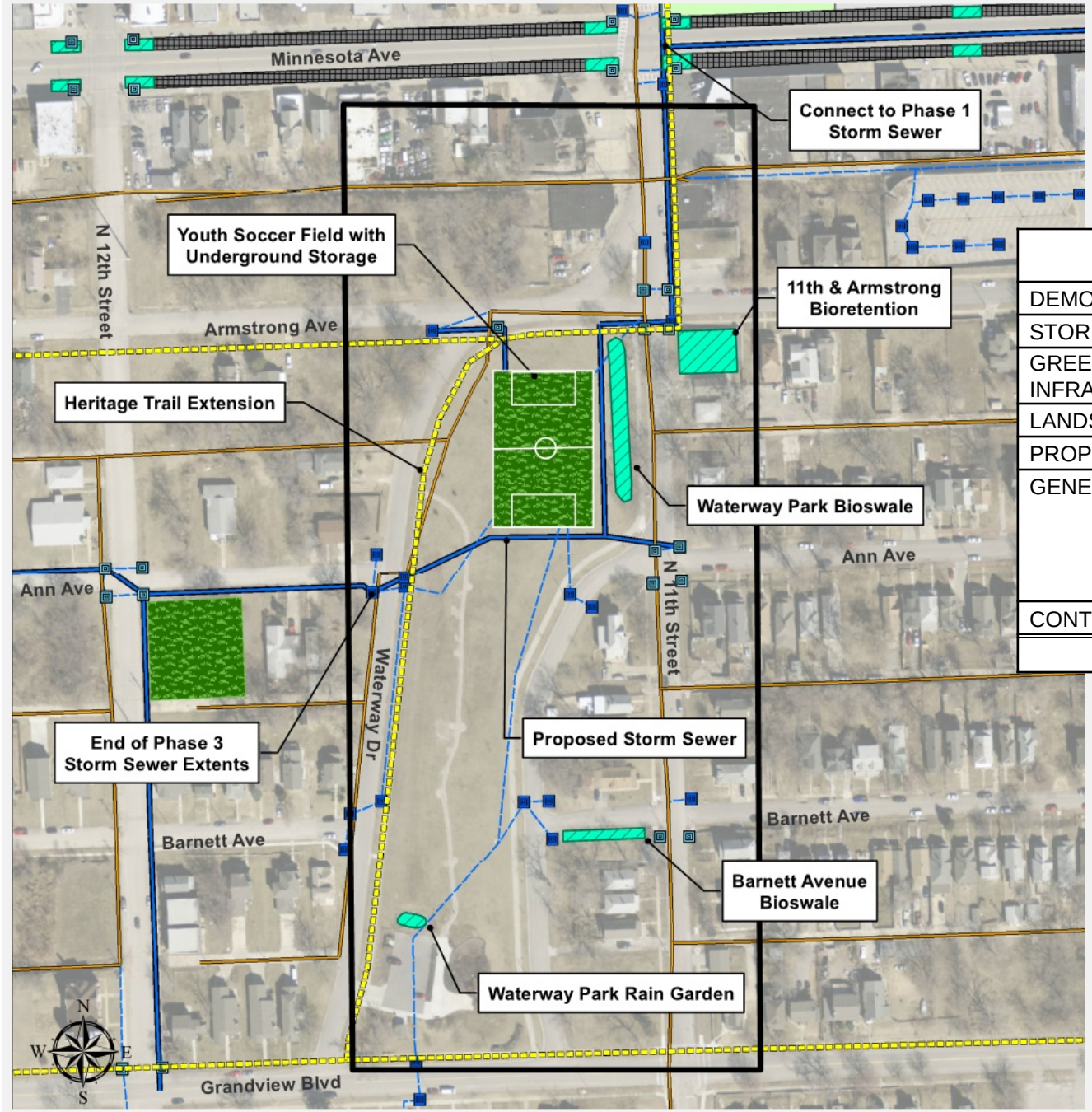
Key Features:

- Reinvest in existing features
- Reconfigure outlet control
- Connect and infiltrate stormwater
- Design Parameters
  - 0.10 acre green area
  - *Rain Garden*
    - Ponding depth = 9”
    - Media depth = 30”
    - Aggregate depth = 12”
  - *Bioswale*
    - Ponding depth = 6”
    - Media depth = 30”
  - Control Acres = 3

Multi-Benefits

- *Enhance and connect parks*
- *Pilot GSI*

Unified Green Phase 3: Opinion of Probable Cost Summary



COST SUMMARY CATEGORY	PHASE 3: Range of Cost	
DEMOLITION/RESTORATION	$208,000	$208,000
STORM SEWER CONSTRUCTION	$341,000	$483,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION	$662,000	$662,000
LANDSCAPING	$112,000	$112,000
PROPERTY ACQUISITION	$169,000	$169,000
GENERAL CONSTRUCTION E&S Control – 5% Traffic Control – 2% Engineering Design – 15%	$290,000	$322,000
CONTINGENCY (25%)	$446,000	$489,000
TOTAL	**$2,300,000**	**$2,500,000**

- Cost per Gallon (681,000 gal)
  - $3.70 Total Phase
- Cost per Control Acre (43 acres)
  - $58,000 Total Phase

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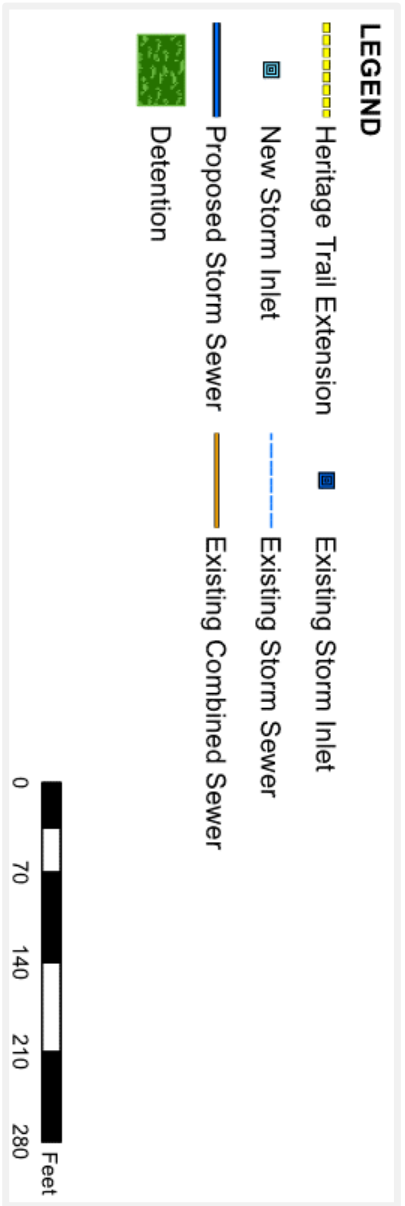

Unified Green Phase 4: Storm Sewer Separation

UNIFIED GOVERNMENT • Wyandotte County • Kansas City, Kansas

Key Features:

- New stormwater interceptor
  - west on Ann Ave,
  - south on 12th, and
  - south on 13th
- *Level of service TBD*
- Remove / strategically place new inlets

Multi-Benefits

- *Reduce stormwater to priority outfall*

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Unified Green Phase 4: 12th & Ann Detention Basin

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Existing property at southeast corner of Ann Ave and N 12th St

Example: Detention basin, Lydia Ave and E83rd Terr, Kansas City, MO

Key Features:

- Low flows diverted from new storm line to detention
- Detention in existing low area
- Repurpose Land Bank property
- Design Parameters
  - 0.40 acre green area
  - Ponding depth = 24”
  - Control Acres = 17

Multi-Benefits

- *Pilot GSI*

LEGEND

- Heritage Trail Extension
- New Storm Inlet
- Proposed Storm Sewer
- Detention
- Existing Storm Inlet
- Existing Storm Sewer
- Existing Combined Sewer

0 70 140 210 280 Feet

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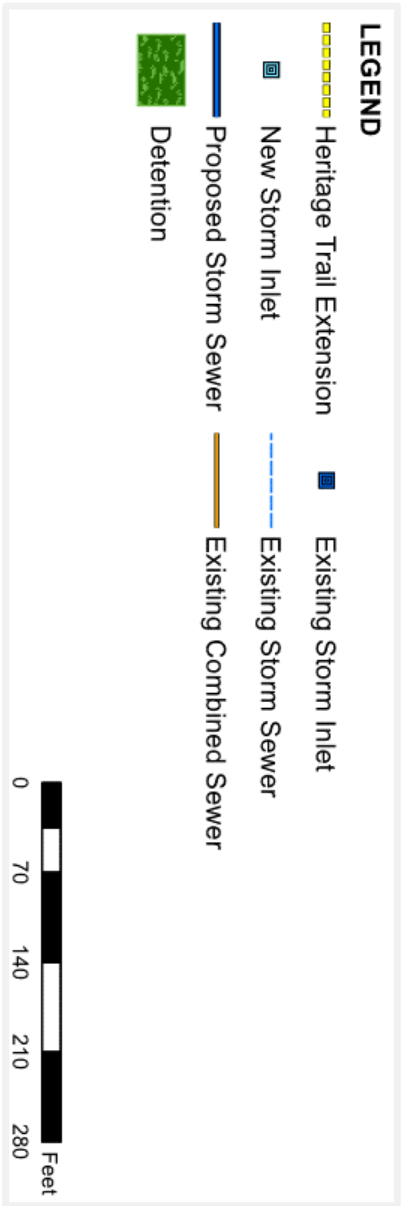

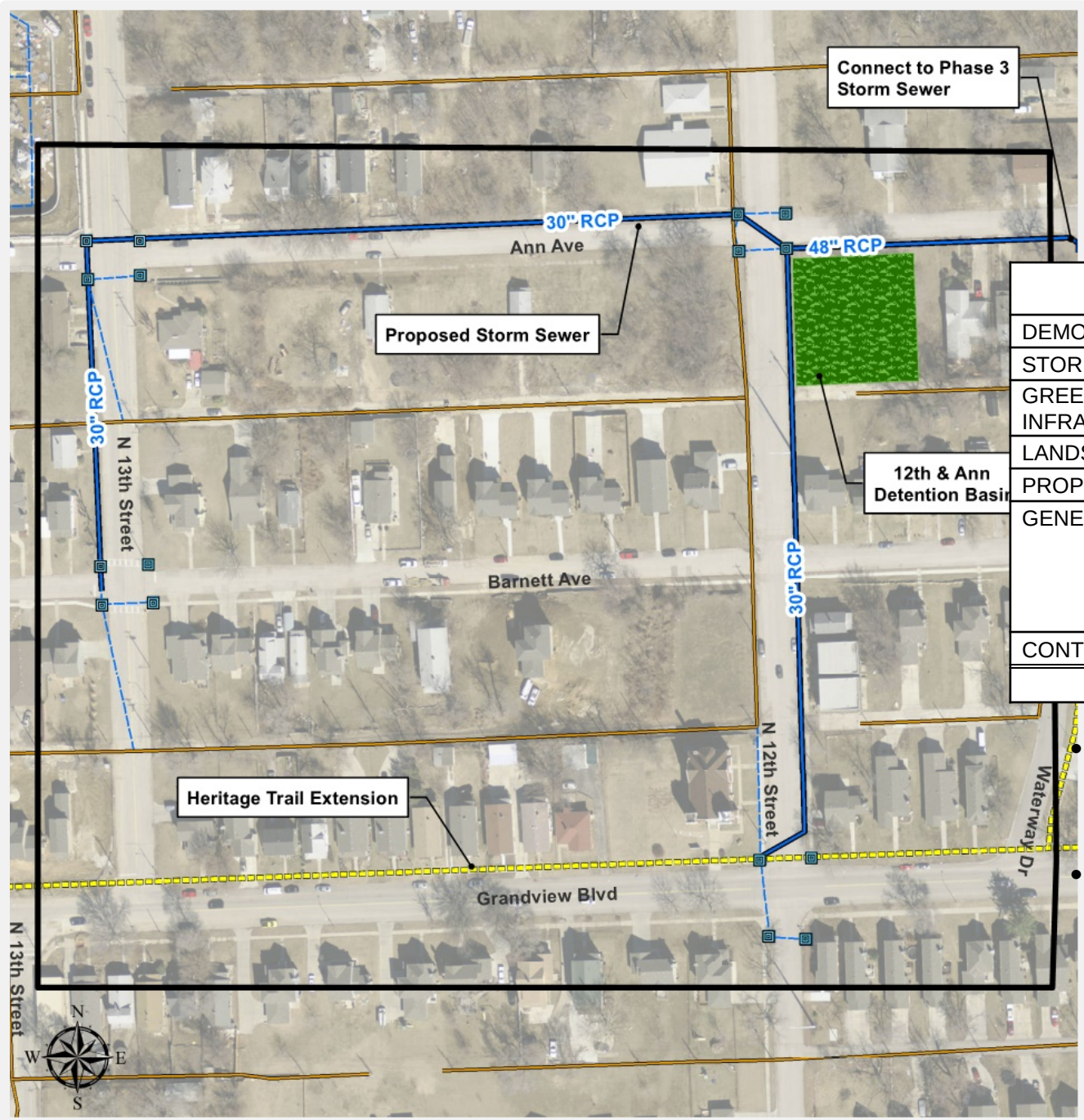

Unified Green Phase 4: Opinion of Probable Cost Summary

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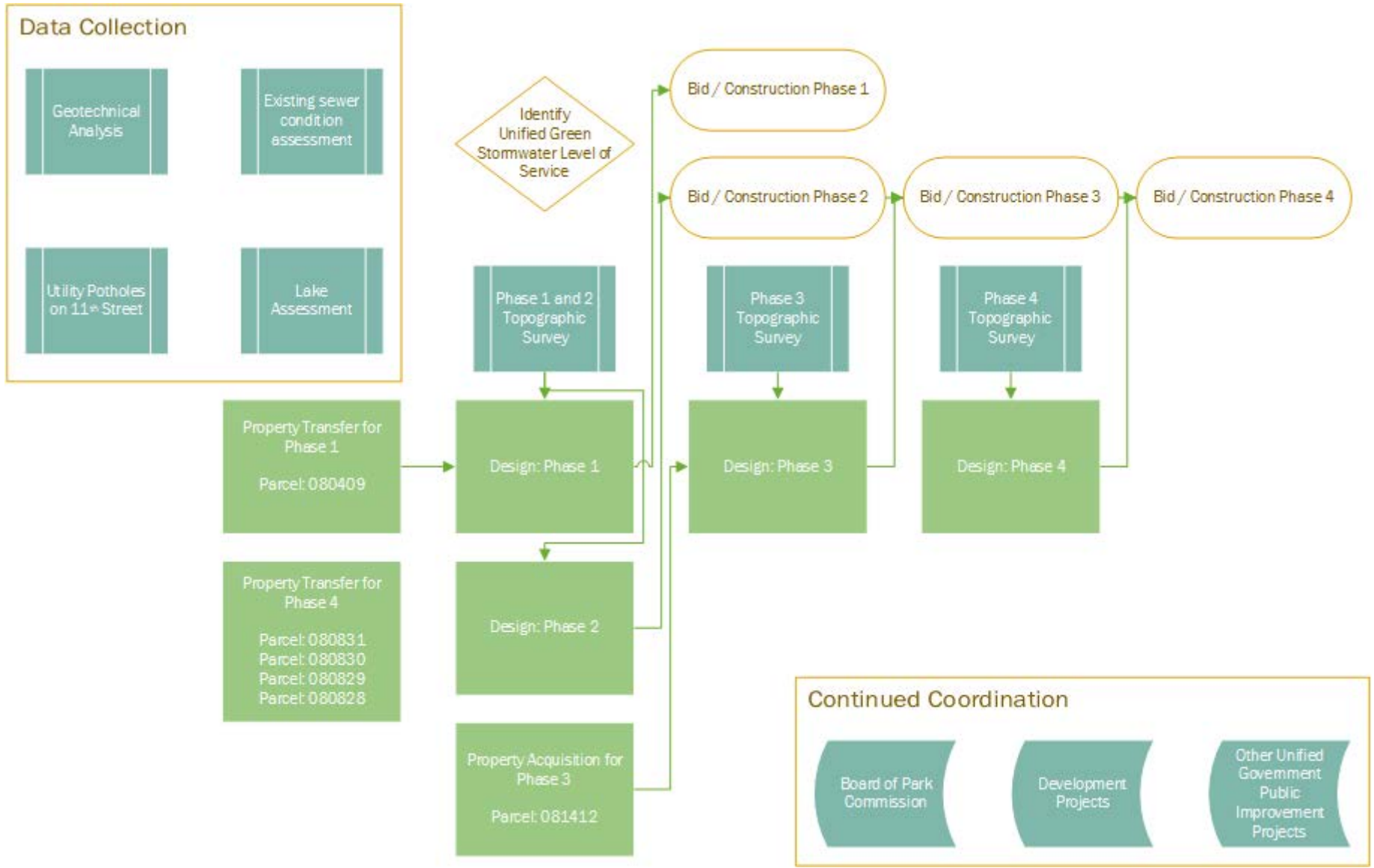
COST SUMMARY CATEGORY	PHASE 4: Range of Cost	
DEMOLITION/RESTORATION	$391,000	$391,000
STORM SEWER CONSTRUCTION	$341,000	$402,000
GREEN STORMWATER INFRASTRUCTURE CONSTRUCTION	$9,000	$9,000
LANDSCAPING	$13,000	$13,000
PROPERTY ACQUISITION	-	-
GENERAL CONSTRUCTION E&S Control – 5% Traffic Control – 2% Engineering Design – 15%	$166,000	$179,000
CONTINGENCY (25%)	$230,000	$249,000
TOTAL	**$1,200,000**	**$1,300,000**

- Cost per Gallon (255,000 gal)
  - $5.10 Total Phase
- Cost per Control Acre (17 acres)
  - $80,000 Total Phase

Next Steps

- *Define* level of stormwater service
- *Incorporate* rehab needs (sewer, water)
- *Complete* Big 11 Lake Assessment
  - Bathymetric Survey
  - Sediment Probes (define thickness)
  - Sediment core sampling
  - Pressure transducer monitor and rain gage
- *Plan* for design
  - ***What green stormwater infrastructure will UG pilot?***
  - ***How does this integrate with Healthy Campus Plan?***


Data Collection
Geotechnical Analysis
Existing sewer condition assessment
Utility Potholes on 11th Street
Lake Assessment
Identify Unified Green Stormwater Level of Service
Bid / Construction Phase 1
Bid / Construction Phase 2
Bid / Construction Phase 3
Bid / Construction Phase 4
Phase 1 and 2 Topographic Survey
Phase 3 Topographic Survey
Phase 4 Topographic Survey
Property Transfer for Phase 1
Parcel: 080409
Design: Phase 1
Design: Phase 3
Design: Phase 4
Property Transfer for Phase 4
Parcel: 080831
Parcel: 080830
Parcel: 080829
Parcel: 080828
Design: Phase 2
Property Acquisition for Phase 3
Parcel: 081412
Continued Coordination
Board of Park Commission
Development Projects
Other Unified Government Public Improvement Projects

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